PLANT ACCESSORIES NUMBER

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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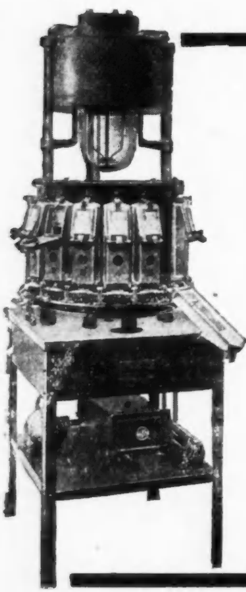

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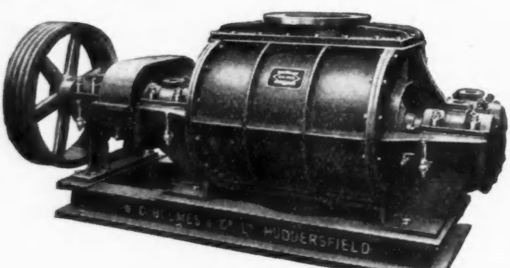

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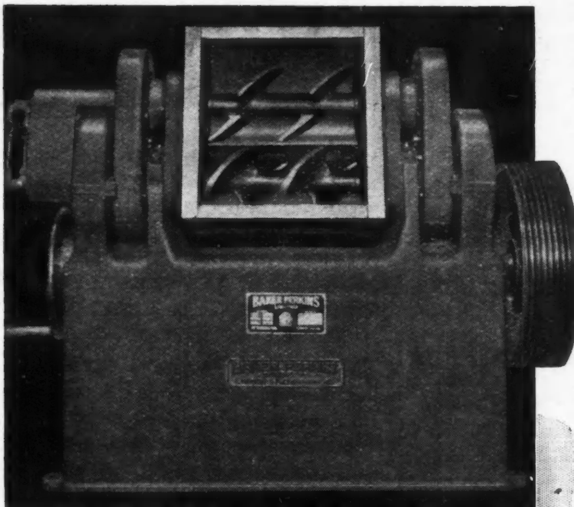

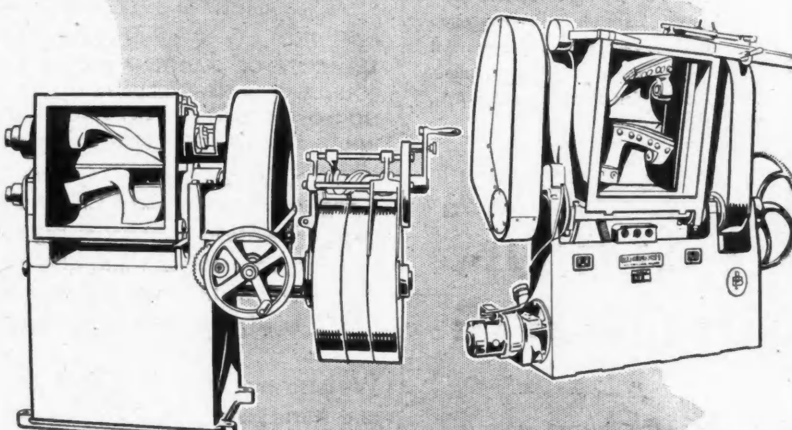

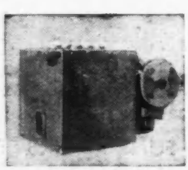

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The Chemical Age

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Plant Accessories

THERE was a time, less than 100 years ago, when industry operated with little or no assistance from what are now known as "accessories." Operations were of the simplest, and waste was not regarded as serious, provided that the price obtainable for the product was sufficient to cover manufacturing costs. As technical skill increased, waste became a serious handicap because others who did not countenance slipshod methods could produce more cheaply, and thus in their own interests all manufacturers had to operate with some approach to efficiency. The degree of efficiency depended on circumstances, and it is a curious commentary on the slow growth of knowledge even amid the modern volume of printed exhortation and instruction that the fuel efficiency campaign conducted by leading industrialists on behalf of the Ministry of Fuel has revealed an astonishingly low level of efficiency in fuel-utilisation. If this low level has been disclosed in one phase of industry, is the level likely to be any higher in other directions? It was not until the attention of managements was drawn to the subject by the decreasing availability of fuel, and the provision of assistance from without to put matters in order, that the position became realised; it would be well for works managers generally to examine the possibilities of more efficient operation in every direction.

Plant accessories are a very considerable help in this direction, but it is necessary that they should be installed with full knowledge of their capabilities and performance, and under expert advice, and that they should be of the very highest quality. It is furthermore equally necessary that they should be maintained in good working order and used properly. A common example is that of steam traps, few accessories being more misused. It is quite common to find these are not operating effectively, steam being blown to waste, or the heat in the exhaust steam not being utilised. One of the vexed questions of steam-trap manipulation is that of group trapping. When a number of steam-heated vessels start up at different times, are on varying loads, and finish at different times, what practice should be adopted? There are engineers of experience who can recall how the consumption of steam has been reduced by removing all existing traps and putting one good modern trap in their place. The

On Other Pages

reason for the improvement has been that several inefficient traps—they may be good traps that have been allowed to get out of order—have been replaced by one efficient trap, so improving the overall efficiency of the system. The right answer, however, is not generally to be found in group-trapping. There is only one set of circumstances in which group-trapping is admissible: (1) Each vessel must have a separate condensate pipe right into the trapping receiver, (2) the trap must have a water volume above the bottom of the pipe equal to the total volume of all the pipes leading into it, (3) the condensate pipes must therefore go nearly to the bottom of the trapping receiver, (4) these pipes must have a sufficient bore to preclude the possibility of steam locking, and (5) the trap must be situated so far below the vessels being drained that the greatest pressure difference that ever occurs between any two vessels is equalled by the hydrostatic head in the pipes leading to the trapping receiver. For instance, if one vessel has a pressure of 15 lb./sq. in. at one stage in the cycle and its neighbour may have 5 lb.—a pressure difference equivalent to 23 ft. of hydrostatic head—the trap must be at least 23 ft. below the vessels, in order to prevent waterlogging; otherwise, with insufficient hydrostatic head, water will build up in the pipes and thence up into the steam heating space, or the coils in the vessel being heated; output would then be reduced because the heating would be largely by hot water instead of steam. This somewhat technical matter has been mentioned here in some detail to illustrate the point that, while plant accessories must be selected with care for the purpose for which they are used, and while they must be properly maintained, expert advice in their installation and operation should also be secured right from the start.

Automatic control is a form of plant accessory that is increasingly coming into favour. It has many obvious advantages over manual control. No labour is required, so long as the instrument is maintained in good order. The instrument can "sense" coming changes that need correcting, long before they would become perceptible to a human being, even if his attention were riveted on the process. Thermostatic control of space heating has led to enormous savings in fuel. Thermostatic control of many chemical processes prevents correspondingly large wastages in process work. In other chemical operations where fine temperature control is imperative, only by thermostatic control does the operation become possible. Pressure control is likewise highly important and can be applied to many processes where temperature control is inapplicable. Nearly any physical property that is changing with changing conditions can be utilised for the purpose of automatic control, and thus automatic control has now been elevated into a plant accessory of the highest importance.

It is sometimes difficult to distinguish between a plant and its accessory. A piece of apparatus that is an accessory for one process may be part of the plant for another. In the widest sense of the word, motors, conveyors, recording instruments, control instruments, valves, switchgear, jets, screens, and so forth, may be termed accessories. But whichever word is used, the fundamental principles of selection and operation remain the same—the correct design and quality must be provided, and the apparatus must be maintained continuously in good condition. Under war conditions lack of maintenance is most often the factor responsible for breakdowns. Shortage of skilled labour, shortage of materials, and difficulties in getting replacements and spares are all enemies of efficient operation. There was an old nursery rhyme which recalled how a battle was lost because of a single horse-shoe nail, and in chemical engineering it is equally true that one weak link in the whole chain of the process may adversely affect the operation of the entire plant.

The shortage of labour means in effect that more reliance must be placed upon machinery. It also means that since less time is available for manual control, there must be more recording instruments and automatic control. The plant for any manufacturing process generally consists of the structural shell or body, and a number of accessories. The shell cannot function without the accessories. It is therefore sound economics to instal as many aids to operation as can reasonably be used, and to instal the very best accessories for the purpose.

NOTES AND COMMENTS

F.B.I. Research Report

BELATEDLY we have received a copy of the report on industrial research issued by the Federation of British Industries. This report is the work of a special committee, headed by Sir William Larke, and including Dr. W. T. K. Braunholtz, Dr. P. Dunsheath, Dr. W. H. Glover, Dr. W. T. Griffiths, Lord Melchett, Mr. R. O'F. Oakley, Dr. C. C. Paterson, Dr. R. E. Slade, and the late Dr. W. H. Hatfield. The quality of the committee's membership is reflected in the excellence and sound balance of the report. Most of the ground it covers is inevitably familiar, but the arguments and recommendations it presents gain force from the mere fact that the report is published by the F.B.I. having indeed received the approval of the Federation's Grand Council. It regards the case for increased expenditure on research as already proved, and adopts as its axiom the belief that applied research is a certain means of increasing employment by creating new industries and improving existing ones. The converse of this axiom provides a slogan that should be widely used to convince the unprogressive industrialist —lack of research spells stagnation and ultimate bankruptcy.

What Firms are Spending

FOR ourselves, the facts about the research expenditure of individual firms were not the least interesting part of the report, because of their novelty. On this subject the F.B.I. committee has been able to collect data from firms which would most certainly have given a quite blank refusal had even such an impartial body as the Royal Society attempted to obtain it. According to the report, the expenditure on research and development of 422 firms amounted to £1,736,000 in 1930. For 1935 and 1938, the figures were £2,696,000 (for 484 firms) and £5,442,000 (for 566 firms). It should be noted that these figures are neither complete nor comparable, but they can serve as some measure of the order of the research activity of individual firms, nationally considered. The report hastens to add that "money cannot create a Faraday, though it may provide facilities for his development." It might have pointed out that Faraday was fortunate to have the green light in his favour; perhaps among his contemporaries there were other men who were lost to science because they had no opportunity to develop their scientific genius, being denied the full facilities of the Royal Institution and the patronage of Sir Humphry Davy.

The Committee's Suggestions

IN spite of this argument that money will not create geniuses—in any event, does industrial research as described in the report depend so entirely upon geniuses?—the report goes on to make recommendations which are mainly connected with finance, thereby admitting that money is the *limiting* factor, even though it is far from being the only factor involved. The committee recommends that every manufacturing firm should ensure that its expenditure on research and development is commensurate with the magnitude of its problems, adding that, wherever possible, firms should maintain their own research departments. The least that a firm should do is to "entrust one or more suitably qualified individuals with the responsibility of keeping constantly under review the application of research to its activities, and for initiating such investigations as may from time to time prove desirable." The report also calls upon firms to support, by adequate financial contributions, their collective research associations. Where such associations do not already exist, the industry concerned should set up research committees to decide whether the problems of the particular industry could be dealt with extramurally.

Task of the D.S.I.R.

THE D.S.I.R. is asked to make the maximum use of its powers of granting money to research associations and organisations fulfilling similar purposes. The committee wants the D.S.I.R. to receive more public money so that it may carry out the foregoing recommendations. In order that the D.S.I.R. may be put in the position of being able to make grants for any research or development of national importance, the Government should allo-

cate an annual sum of at least £1,000,000 for the maintenance and expansion of D.S.I.R. activities. The final recommendation advocates the setting-up of a Bureau of Industrial Research "which should be national in scope and though financially supported by those principally concerned, such as research associations, independent research laboratories, Governmental research establishments, universities, and others, should be entirely objective in its activities." As we understand it, this organisation would provide an intelligence service dealing with research matters.

More B.B.C. Science

IT is obvious from the letters which we publish this week that there exists among scientists a strong feeling that the science programmes of the B.B.C. could be much improved. Speakers at the recent British Association conference which discussed the subject of "Science and the Citizen" were emphatic in their disapproval of the way in which science is presented over the radio. The engineers and scientists who have made radio possible have no say at all in the building of radio programmes; as Sir Robert Watson-Watt put it, "We are only the plumbers." At that conference the plumbers proceeded to trace the hole in the leaky pipe, and they came to a unanimous conclusion that the major fault was the lack of liaison between Broadcasting House and the scientific world.

Liaison Officer Wanted

THERE was general agreement, too, as to how that liaison could be effected. Dr. C. D. Darlington wanted a scientist on the Board of Governors of the B.B.C., as well as a science committee to prepare, co-ordinate, and direct the policy of programme-building so far as science was concerned. Dr. D. McClean supported this proposal for a permanent committee of scientists to advise and develop ideas for B.B.C. programmes. He also indicated the necessity of having a science programme officer, who would be chosen by the B.B.C. to maintain liaison between the devisers of radio programmes and the science committee. Sir Allan Powell, chairman of the B.B.C., presided over this British Association meeting and he gave his approval to the idea of a scientific committee. We understand that several scientists have since attempted to get Sir Allan to put his verbal approval into practice, but without success up to date. The least that the B.B.C. could do is to appoint a science programme officer at once. At the moment Broadcasting House would find the most suitable candidates for the post among its own personnel; they are producing short but excellent science programmes for overseas listeners. The people of Britain are less fortunate. Those in charge of home broadcasting do not seem to be so well informed about recent scientific developments, nor do they seem to realise that the number of scientists who are also good speakers is many times larger than the authorised establishment of the Brains Trust.

Workmen's Compensation

IN a general way, the Workmen's Compensation Bill, which was read for a second time in the House of Commons last week, met with the qualified approval of all parties, and Mr. Morrison had little difficulty in passing it through this stage. At the same time it is universally agreed that the Bill—one of several such that has passed through the House during the war—must not be regarded as anything more than a stop-gap, although a very necessary stop-gap. In principle, it contains no revolutionary changes, but it does imply that a further £5,000,000 will be added to the cost of compensation, bringing the total to £17,500,000, an increase of 75 per cent. on the 1938 figure. Even now, however, there will be hard cases that will not be adequately compensated; some, indeed, never can be so long as the present system of compensation prevails. Mr. Quintin Hogg adumbrated the kind of compensatory mechanism which is likely to come into being after the war, whereby the charge will be on some sort of social security fund instead of on the employers; and Mr. Peake expressed the Government's pious hope that some such change would indeed be made. The new scheme, it is hoped, will come up for debate before long; meanwhile, the present Bill will help to relieve some of the hardest cases, and must be regarded as quite a useful jury-mast.

Unit Plant Developments

Some Results of Recent Research

THE following notes refer only to new developments in unit plants which have been made recently and do not include any mention of new chemical processes. It will be appreciated that the new chemical processes developed by the Kestner Evaporator & Engineering Co., Ltd., have been for Government departments or firms working on vital war production, so that it is not possible to give any information regarding them under present-day conditions. It is felt, however, that the considerable variety of plant unit developments which have been made by the company in the last 18 months will be of considerable interest to the chemical and allied industries. Some of these developments are the outcome of many years' research and investigation work in the company's laboratory and testing plant, and they represent new methods of carrying out work on unit processes. Other developments mentioned in the notes below are more in the nature of refinements and improvements to unit processes which are well known in the chemical industry.

A New Type of Crystalliser

In many chemical works, corrosive liquors, such as ammonium sulphate, ferrous sulphate, etc., have to be crystallised, but owing to their corrosive nature the construction of ordinary forms of crystallisers presents considerable difficulty and entails heavy upkeep charges. A new method of crystallising such liquors has been introduced which may be described briefly in the following way.

The liquor is warmed up and fed on to a specially designed rotary atomiser which sprays the liquor into a cylindrical chamber. In this chamber a current of cold air is blown uniformly over the hot spray so causing rapid cooling and crystallisation in each spray particle; the crystals and "mother" liquor strike the wall of the chamber and fall down to the bottom where they are collected in a settling tank. From this settling tank the "mother" liquor is drawn off continuously and pumped back to the spray and the crystals discharged continuously or in batches to a centrifuge or other well-known apparatus. The incoming liquor is fed continuously with the return "mother" liquor to the spray and the air is discharged continuously from the spray chamber into the atmosphere. Both the atomiser and chamber can be made in acid-resisting materials such as lead, stainless steel, or Keebush, and since the process works continuously, labour and handling charges are reduced to an absolute minimum. This method of crystallising has been covered by patent applications.

The use of silica gel air and gas driers has been well established in industry, but in the past, for continuous operation, double absorber units have been applied, in which one absorber is regenerating while the other is in use. This necessitates the attention of an operator who must change over the flow of air or gas from one absorber to the other when required and must also start up the regenerating heater. In order to eliminate manual operation an improved system has been introduced in which the change-over from one absorber to the other is carried out electrically, and the start-up and running of the regenerating system is automatically controlled by means of a process timeclock. Kestner Silica Gel Air Driers of this type are now being installed in power stations for use in conjunction with pneumatic switch gear in factories where mechanisation of all processes has been carried out to a high degree.

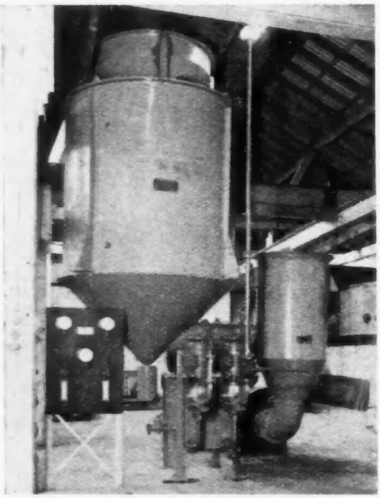
The Kestner T.V. Drier, which was introduced in recent years, has been installed in a number of works for drying filter-press cakes and other semi-solid materials. One of these plants is of special interest in that it is for drying borax. It is essential, for the required degree of purity in the borax, that no metallic contact should be allowed at all. This has been achieved by constructing the entire drying system in Keebush plastic material; the rotary screw feeder and the drying column, the cyclone separator, and the hot-air fan are all made in Keebush.

New Type of Evaporator

The concentration of industrial liquors which contain salts having inverse solubility ratios has for a long time presented a difficult problem to chemical engineers. The greatest trouble is due to the fact that heating surfaces, whether the evaporator be an ordinary jacketed pan or a tubular type, become rapidly scaled with deposited salts. This has been overcome by a new system of evaporation in which the liquor is sprayed into a chamber and subjected to a current of hot air. The spray particles evaporate and fall to the bottom of the chamber where they are collected and removed continuously. Any salt which tends to form is continously washed from the walls of the chamber by downcoming liquor.

It will be seen that in this method of evaporation there is no heating surface on which scale can form, since the heat is supplied directly to the liquor by means of hot air. This new type of evaporator also lends itself readily to construction in acid-resisting materials and can be used successfully

for handling corrosive liquors which have to be concentrated. This new method of



Kestner Spray Evaporator.

evaporation has been covered by patent applications.

Axial Flow Fans

During the last twelve months a comprehensive range of high-efficiency axial flow fans has been introduced for handling corrosive gases. These fans have been designed on the most recent advances in aerodynamic technology; the blades are carefully shaped with aero foil section from tip to root, and the overall efficiency is exceptionally high. In order that trouble-free working may be assured, even with highly corrosive gases such as chlorine and hydrochloric acid gas, the whole of the impeller blades and the case are made in Keebush or other acid-resisting material to suit the particular gas being handled. A special design of internal roller bearing is employed, which is entirely shrouded by acid-resisting material, and the possibility of corrosive gas reaching the bearing is eliminated.

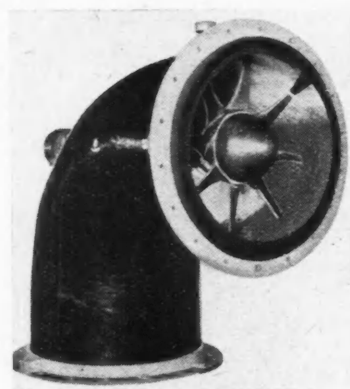
These fans are being used with great success for draughting acid pickling tanks, chemical reactions in vessels giving rise to hydrochloric acid fumes, leaching vats for tanneries, draughting large fume cupboards, etc., and they are made in sizes from 4 in. diameter to 4 ft. diameter.

Self-Priming Acid Pump

Kestner glandless acid pumps have been known for some years and installed in chemical works throughout the world. The latest improvement which has recently been patented renders the pump self-priming, so that there is no need for a foot valve or other priming mechanism. These new glandless self-priming pumps can be installed at some distance away from and above the tanks which they are emptying, and may be started and stopped simply by electrical push-button control. The advantages of a self-priming unit, combined with the fact that there is no gland or gland-packing, enable the handling of even highly corrosive acids to be carried out just as simply as in the case of pumping water.

Vacuum Ejector for Corrosive Gas

In many chemical processes it is necessary to apply a vacuum to liquors containing corrosive fumes. For this purpose a simple form of jet-type ejector has been designed and it may be operated either from



Axial flow fan made in Keebush.

water at 40 lb./sq. in. or by steam. The ejector is made entirely of Keebush material and will pull a vacuum of 28½ in. working in a single stage. These ejectors have been supplied largely for working vacuum filters where sulphur dioxide and hydrochloric acid vapour are evolved.

Argentina now exports in volume several industrial chemical products. These include stearic and tartaric acids, and paint.

Construction has begun at S. Vicente, near Santos (Brazil) of a plant to produce caustic soda, chlorine, and derivatives by the electrolytic process.

Portugal faces a shortage of copper sulphate. Vineyards, for instance, are receiving only 60 per cent. of the amounts required to keep fungus diseases under control.

Plant Accessories and Fuel Economy

Some Observations by a Steam User

TO-DAY, when we are continuously reminded about salvage, economy, wise spending, saving for investment in war loan, and being more self-sufficient with regard to raw materials—on all of which, incidentally, we are offered advice from all directions, some good, some ill-informed but well meaning—it was not surprising that when asked to write a contribution on plant accessories I, too, was reminded that "the accent to-day is that of fuel economy."

The chemical industry is a large user of steam, both for heating purposes and for motive power, and therefore a large user of fuel. This has been so for a considerable number of years, and "economy in the operation and maintenance of steam generating plant" has been preached in a thousand papers read before our technical societies and contributed to the technical press. I will say no more on that point, beyond remarking that *fuel economy does not mean a rigid saving of fuel*, as we are so often led to believe, *but conversion into heat without preventable loss*, and *the conversion of heat into steam also without preventable loss*. With that object a variety of accessories for steam-raising plant have been devised and placed on the market, and adopted by wise users of steam. As to the details of these various accessories, it is best that the makers themselves should be consulted; there are many of them and they have for many years had the welfare of their manufactures of heart. They have invented and designed for a purpose, and in selling they have gathered a wealth of data from the experience of steam users, upon which it has been possible to base new patterns or to offer old patterns again with greater confidence than ever before.

The Boiler Man

It is by the use of such accessories, wisely selected to suit the conditions, that the greatest measure of fuel economy can be attained. To this must be added one more proviso—the boiler plant must be in the charge of a man who really knows his job, and the staff under him must also be men of experience. Indeed, it is not too much to say that while some chemical concerns have very fine steam plant that operates with the utmost degree of economy—and did so long before the present campaign of using fuel without waste—there are others whose plant would now be working rather more efficiently had they been wiser in the choice of accessories, and had they taken better valuation of the man who stokes and keeps the supply of steam flowing.

To name the various accessory features of steam raising plant would be to convert this article into a manufacturer's catalogue; such literature is still available to bona-fide users, in spite of paper shortage. A textbook upon the subject of steam-raising will give details of steam plant, and of its purpose. Economy being the accent to-day, let us look at a few of the factors involved in the generation and utilisation of steam, and then, if we are so minded, turn to the manufacturers' literature for details of the accessories which call for attention, and go to the makers for that sound advice which they are able and willing to offer. Manufacturers of steam plant accessories are of the highest standing, and possibly in no other type of engineering has so much money and thought been expended upon improving the product, which now reaches a very high standard in quality and performance. This is not surprising when we remember that the chemical industry is only one of the many users of steam.

Improved Efficiency

Possibly little more is to be done in raising efficiency in the use of coal to produce steam, whether the process is considered from the point of view of the calorific value of coal, or the steam pressures and temperatures. Cheaper grades of coal, however, have been pressed into service, while on the other hand there has also been a trend to provide very clean coal of low ash-content. Such changes have affected the cost of maintenance for the grate, and have sometimes demanded modifications as, for instance, with mechanical stokers requiring thin links and fine air-spacing to suit the conditions of the fuel. There have also been improvements in the quality of firebars and of refractory bricks to reduce maintenance under increased rates of combustion, in draught-control, and in the cooling of furnace walls by water tubes connected with the circulation system of the boiler. A good deal of attention has been paid to feed-water temperature, air pre-heating to give better absorption of heat from flue gases, and also to the control of combustion to minimise wastage in the form of smoke.

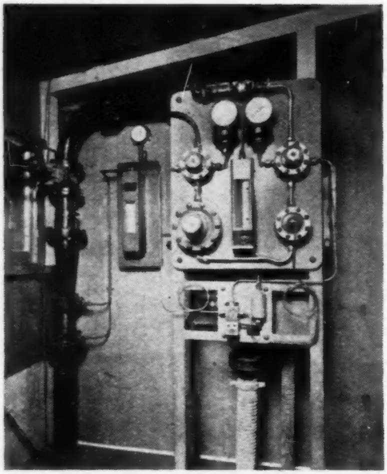
Indicating and recording instruments have again proved their worth by providing valuable data, showing where losses of steam occur (and loss of steam represents loss of fuel *plus* the cost of converting the fuel into steam). Better lagging, with an eye to the most economic thickness of insulating material; better removal of condensate from steam pipes by using the most desirable type of steam trap; better ar-

(*Continued at foot of p.* 430)

Chlorination Equipment

For Sterilising Cooling Water

ONE of the troubles in using cooling water is the gradual growth in the pipes, coils, jackets, condensers, and similar spaces, of micro-organisms, chiefly algæ and



The Paterson Chloronome.

protozoa, which form a slimy deposit. This possesses pronounced insulating properties, so that the efficiency of the cooling water is thereby reduced to a serious extent, while in bad cases the deposit may increase to such a degree that choking and irregular circulation of the water result. The trouble also varies according to atmospheric temperature; as a rule it is worse in summer than in winter.

The remedy lies in treating the cooling water with a measured trace of chlorine gas, on lines that are now standard scientific practice for the turbine condensers and cooling towers at power stations. In this connection organic deposits are so serious that they lead to an increase of about 5 per cent. on the coal bill; probably more than 500,000 tons of coal a year are wasted in Great Britain in power stations not equipped with chlorination plant.

The pioneers in this field are the Paterson Engineering Co., Ltd., of London, who in 1922 installed the first chlorination plant of this kind in the world at a London power station. Since then they have equipped many power stations, both at home and abroad, but it is not generally realised the method is of great value for industrial cooling water in conjunction, for example, with refrigerators, cooling coils, jacketed pans, air compressors, internal-combustion engines, general condensers for distillation and, of course, steam-engine and turbine condensers of all sizes.

For the purpose the firm use their well-known "Chloronome" equipment, available in different types, all of which, however, operate on the same principle, comprising essentially a metal panel with control-valve, pressure gauge, metering device, chlorine filter, moisture seal and two pressure-reducing valves in series, coupled up with a supply of chlorine, either in drums or cylinders, by narrow-diameter flexible copper tubing. The chlorine gas can be admitted continuously at any desired rate, passing into a small stoneware tower that forms part of the equipment to make a comparatively strong solution of chlorine in water, which is then discharged to the cooling water circuit, ensuring rapid and uniform mixing. While conditions differ, roughly 0.5 parts of chlorine are required per 1,000,000 parts of water, and equipment is available for dealing with as little as 0.4 lb. of chlorine per hour.

(*Continued from p. 429*)

rangements for treating the feed-water to reduce scale, foaming, priming, corrosion and embrittlement; all these have made their contribution and enabled fuel to be converted into steam with the highest efficiency.

Good maintenance is of the highest importance for steam-raising plant; there are no accessories which offset the need for continuous inspection, but the cost of any necessary repairs can be greatly reduced by a wise choice of plant accessories. Brickwork must be kept air- and gas-tight, with no air creeping through cracks and crevices. When draught is not under proper control there can be serious maintenance costs, as from damage to stokers, pulverised-fuel burners, firebars and brickwork. The efficient removal of dust from the combustion gases is also necessary if the erosion of fans, used for inducing draught, is to be avoided. Again, if any of the steam is to be used for driving turbines, there must be steam-purifying and drying equipment to remove all solid particles (mainly from boiler scale and by entrainment from the feed water), and likewise to reduce the moisture content of the steam to a desirable minimum; solid particles carried with the steam quickly damage the blades of a steam turbine.

Waste Oil Recovery

A Useful Series of Filters

ONE of the results of the present increase in engineering production is the huge demand for lubricating oils; and, of course, as waste oil can be cleaned and rendered suitable for re-use, it is obvious that oil-cleaning apparatus has become a necessary aid to economic production. A. C. Wells & Co., Ltd., of Providence Mill, Alexandra Street, Hyde, Cheshire, manufacture a waste-oil filter which is one of the most efficient of these appliances, and its simplicity of operation is clearly demonstrated in the following illustrations.

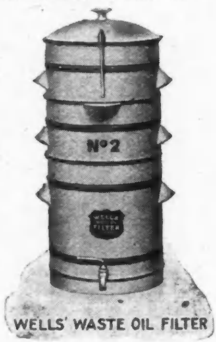


Fig. 1.

Fig. 1 shows the No. 2 size, which can settle and filter 8 gallons of waste oil per week (of 12 working hours a day), but this figure can be more than doubled by the addition of steam heating coils or electric heaters which can be fitted at proportionately small extra cost. There are five other sizes, one smaller and four larger, and the same additional fittings can also be supplied for Nos. 3, 4, and 5. The largest size, No. 6 model, is fitted as standard with these steam heating coils, its capacity being between 400-450 gallons per week.

Fig. 2, a sectional view of the filter, shows the principle of operation, a feature of which, common to all sizes except No. 1, is the sight-feed syphon. The filter comprises three compartments, each fitting into the other. The top section is a dirt-settling compartment, to the bottom of which is precipitated, by gravity, any solid or heavier-than-oil matter. Here also is located the Wells patent syphon feed which, by means of a tube, syphons off the oil into the middle compartment by way of the lip clearly shown in Fig. 2. This central compartment holds the first filtering pad, made from the finest compressed short-grained cotton, designed for durability and hard wear. The pad, through which all the oil must flow, is in a perforated casing. The oil enters through the perforations in the sides and, having passed through the filtering pad, flows down a channel into the suspended filtering chamber in the bottom compartment.

This compartment consists of two sections—the suspended chamber holding the second filtering pad, and the receiving section into which the filtered oil eventually settles. In the concluding operation the oil, having reached the suspended filtering chamber, is forced upwards through the pad, which is held down on a perforated bottom by a hand screw in a detachable crossbar pressing on to a perforated pressure plate; by this means the density of the filtering pad can be adjusted and the efficiency of the filtration determined. The oil finally runs over the edges of the suspended chamber into the receiving portion, ready to be drawn off for use. From the foregoing description it will be noted that these filters are entirely mechanical and operated only by gravity, and, as no chemical action is involved, the properties of the treated oil are in no way impaired, and it is once more ready for service as a valuable commercial material.

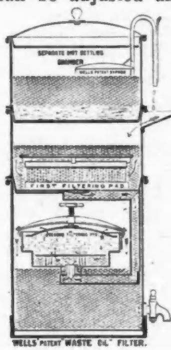


Fig. 2.

Filter Capacities

The following are the approximate capacities of each size filter: No. 1, 1-2 gallons per week; No. 2 (as illustrated), 8 gallons per week (in this size, the two top chambers hold about 2½ gallons of dirty oil and the bottom chamber 3 gallons of clean oil); No. 3, 12 gallons a week; No. 4, 20 gallons; No. 5, 50 gallons; and No. 66, 400-450 gallons per week. Nos. 5 and 6 are also fitted with gauge glasses for clean oil. In quoting these figures it must be remembered that much depends on the thickness of the oil, the amount of dirt and sediment to be removed, and the temperature of the operating room. The figures given are based on oils of ordinary thickness, filtration being carried out in a temperature of about 70°F. Speed of operation can be greatly expedited by increased temperature.

Renewal pads for re-charging the filters can be supplied, when necessary, cut in sets to the correct sizes. A spare set is sent out with every filter, unless otherwise requested. The use of cotton waste or other material in place of the specially prepared cotton pads is not recommended by the makers, as this results in side creep and unsatisfactory filtration.

Silicon-Iron Alloys

For Chemical Pumps and Other Accessories

CONSIDERABLE development is taking place in the use of silicon-iron alloys for chemical plant, and, in spite of the difficulties of working this metal, quite intricate apparatus is being evolved. The actual composition of many of these alloys is secret. They are sold, either in the form of manufactured plant direct to chemical concerns, or as castings to equipment makers, under various names—Meldrum metal. Tantiron, Duriron, Thermisilid, and so on.

Generally speaking, only those parts which actually come into contact with corrosive fluid are made of this alloy, chiefly on the score of expense, though sometimes other factors have to be considered, such as tensile strength. As already mentioned, these alloys are not readily machineable, and this factor, too, is of importance, as it limits the uses to which metal can be put. It must be realised that there is no alloy which is absolutely resistant to all corrosive media, notwithstanding the optimistic claims sometimes made for them, and by far the best procedure is to give the plant manufacturer complete details of the work and the fluid for which the equipment is intended.

Design of Castings

It is possible to produce in silicon iron almost any apparatus that can be made in cast iron, although certain modifications are usually necessary. When designing castings to be produced in these alloys, large plane areas should be avoided. It is often possible in a plane surface to produce castings to a better advantage by using a metal thickness in the centre of about 65 per cent. of the thickness on the edges of the plane. Vessels of whatever form cast in silicon iron often have a bead or rib around the top edge approximately doubling the metal thickness of the balance of the castings. Holes for bolts, outlets, or other purposes are usually made by means of dry sand cores. Where, however, the diameter of the hole is much less than the metal thickness, it is impossible to use such cores, owing to the action of the hot metal on the sand. In such instances steel inserts, afterwards eaten out by acid, are used, this method leaving a clean, smooth hole true to size.

To turn to typical applications of these alloys, such equipment as reciprocating and centrifugal pumps is being successfully produced. Piping to carry acid or alkalis has always been a problem, and with the materials available it has often been possible to select one that would serve fairly well with one particular acid, but in situations where several corrosives were carried it was attacked and eaten out. A good silicon-iron alloy is free from the disadvantages of the normal pipe materials, and being a solid-cast metal it is equally resistant to attack inside, outside, and all through the wall structure. Silicon-iron drainpipe is installed in the same way as easily as cast-iron soil pipe. The fact that acids may be diluted with water when wasted into a drainpipe does not prevent corrosive action. Some acids attack ordinary material more severely when diluted than in their more concentrated form. For example, sulphuric acid of commercial strength may be shipped in steel tank cars, but when diluted it will destroy the tank in a short time.

Ventilating Fans

Ventilating apparatus, employed in many instances as a means of improving working conditions rather than being actively concerned in the operation itself, is, therefore, not subject to the constant attention given to equipment that has to do with the process in hand. Consequently, it should be as nearly automatic as possible. This feature has been taken into account in the design of silicon-iron ventilating fans, and their construction is such that they give continuous and effective service with little care other than lubrication. The fact that they are not dependent on a protective covering for resistance to the fumes handled still further reduces the attention necessary. In addition, the possibility of attaining much higher speeds with silicon-iron fans than with those of other acid-resistant materials, such as lead and stoneware, results in greatly increased exhausting capacities and static pressures over equivalent fans made of other materials.

High-Resistance Pumps

One of the most interesting applications of silicon iron is in pumps for handling chemical liquors. Here the alloy overcomes two great difficulties encountered in many conditions of industrial pumping—corrosion and erosion. Where corrosive liquids must be handled the resistance of the alloy to acids gives long and continued efficiency to the pumps; when solids in suspension are carried, the alloy's extreme hardness withstands the abrasive action, and such pumps continue to operate with unimpaired capacity. Where both conditions are present, these pumps work with equal facility. All parts coming in contact with the fluids handled are made of the alloy; they are ground accurately to gauge and are interchangeable. The intake and discharge valves are of such design that they are self-seating.

For centrifugal pumps, the mechanical properties of the material must, of course,

(*Continued at foot of p. 433*)

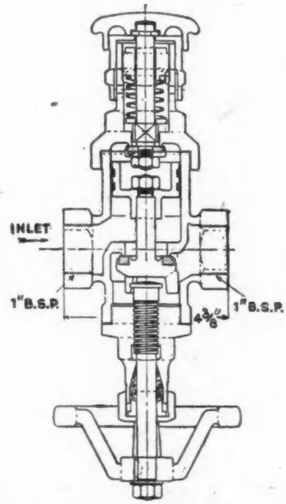
Automatic Trip Air-Valves

A New Safety Design

A NEW automatic trip air-valve which, it is claimed, solves the difficulties of using compressed air-operated equipment is marketed by Hopkinsons, Ltd., Huddersfield. It is made in two forms, a large size for compressed air mains, and a smaller size for the air supply pipe of individual machines. The valve comes into operation automatically as soon as the air pressure falls below that at which the machines can be run and shuts off the air supply, completely and permanently, until re-setting has been carried out by hand.

The working principles of the smaller valve may be described with reference to the sectional diagram. Pressure accumulates in a space above the piston by air leakage past the piston rings and holds a small relay valve on its seat. When the air pressure falls below the usual working pressure a spring opens the relay valve, releasing the air above the piston to atmosphere. The piston is forced up by any pressure remaining in the system, and the main valve is closed. The restoration of the air supply lifts the piston and shuts the valve, which can only be re-set by hand and cannot remain set unless the pressure in the system is sufficient to operate the machine. To re-set, the knob at the top of the equipment is lifted, thus closing the relay valve.

There is a control device at the bottom for regulating the speed of the machine, and once set this is not interfered with, the starting and stopping of the machine being carried out by a knob at the top, which on being lifted, closes the relay valve. Consequently, the pressure builds up above the piston and the main valve opens to the limit set by the hand wheel, the pressure also retaining the relay-operated valve to its seat. In order to stop the machine, the knob is subjected to pressure by hand, or given a slight blow, which opens the relay valve and closes the main air supply valve.



Vertical Section of Hopkinson's automatic trip air valve, with combined control valve.

(*Continued from p.* 432)

be taken into consideration when designing individual parts. In order to comply with foundry requirements, the shape of the various components is kept as simple as possible, and, in addition, the number of surfaces that will require machining is kept as low as possible. In auxiliary pumps for relieving the stuffing-box the steel shaft is protected by a silicon-iron bushing which reaches beyond the stuffing-box. The stuffing-box in some designs of centrifugal pumps is not under liquid pressure and the packing has only to keep the pump from leaking when it is at rest; when the pump is running the auxiliary pump keeps liquid circulating, and thus prevents air being drawn in. The auxiliary equipment is designed in such a way that the packing could be dispensed with altogether if the liquid reached the pump at a pressure of 6½ feet to 10 feet water gauge. In practice, such pumps are known as "acid-resisting pumps without stuffing-boxes." Experience has shown, however, that in most cases it is preferable to provide a relieved stuffing-box packing, as well as the hydraulic packing. Its principal purpose is to prevent the liquid from issuing from the pump when it is at rest; the stuffing-box should be only slightly tightened up. If a pump must work with suction, the sealing liquid is taken to the sealing-liquid space of the stuffing-box from the delivery branch through a special passage. The auxiliary pump also takes up this liquid and sends it back to the suction side of the pump, thus relieving the packing.

The resistance of the silicon-iron alloy to corrosion from acids increases with the proportion of silicon; but at the same time the metal also becomes more brittle. Because of its hardness this material can only be machined by grinding, and it is sensitive to pressure and shocks.

Solid Leather Vee Ropes

Their Use and Maintenance

INTEREST attaches to the production in this country of solid "Vee" ropes. The manufacturers, the Benson Vee Leather Co., Ltd., Longside Lane, Bradford, believe that they are the only firm in existence who have made a practical proposition of such ropes. Standardisation is fairly general in Vee ropes. The standard angle is 40°, and unless specified to the contrary all ropes are taken to be 40°. Standard ropes are usually marked with one of the following letters: M, A, B, C, D and E, the widths of which range from 10 mm. to 1½ in.

As regards circumference of rope, there are variations with standard V ropes. There are four methods of determination: (1) Measuring inside circumference at bottom of grooves in Vee ropes by an ordinary tape measure. These ropes are stated—so many inches "i.c." (2) Calculation of pitch circle diameter from centres and sizes of pulleys and formula for this purpose. This is inches "p.c.d." (pitch, circle, diameter). (3) Measurement by tape measure round outside circumference of ropes when existing ropes are on drive. This is known as inches "o.c." (4) Use of rubber rope manufacturers' code number. Leading rubber rope manufacturers have a stamped number on each rope. Reference to their list can be made and the dimensions of the ropes then are shown.

Engineers are urged to identify Vee ropes by measuring the inside circumference (method No. 1) Once this is in use it is easily understood by all, minimising delay.

Variations of Angle

Variations from the 40° angle are usually two unimportant ones and one important for leather Vee ropes. Two makers use different angles, and those angles are 35° and 38° instead of 40°. On leather Vee ropes these two exceptions are not important because leather beds down to the angle of the pulley within these limits in a very short time. This bedding down is greatly helped, as also is the flexing property of leather Vee ropes, by the application of a few drops, when running, of Revol, made by Revol, Ltd. The important exception is on fan belts, which are usually 28°, and this difference has to be taken care of in manufacture.

Some American machine tools carry ropes and pulley of a special section. When ordering for these, a rough drawing of the cross section should be supplied. The most common size here is the 1 in. section, of which a large number have come in under Lease-Lend. Other exceptional widths are where firms are using special electrical equipment of a light type of their own, or of local design, and secondly, where Vee ropes are being used to replace round leather-banding drives which may have proved too light for the job. Here, again, a cross-section drawing is easily made. Some machines used in quarries have special widths such as 1¾ in. or 2 in.

Rubber Vee rope manufacturers have co-operated to establish individual ranges to take almost every circumference in 1 in. differences, but individually most makers move their circumference up in 3-5 in. jumps. These have become their standards and under existing circumstances it is impossible for them to stop normal processes for a special circumference which comes somewhere between their standards. In leather Vee ropes this point is covered because no standard moulds are used. Leather ropes can be made to the nearest ¼ in. circumference, if specified. A further point to note is that no permit is required to supply to any firms in England, provided that they are on Government contracts.

Economy and Convenience

Other points of interest concerning leather Vee ropes are as follow: (1) Leather can be salvaged. Should damage be done to a set of ropes, new pieces of Vee leather can be jointed into the ropes, as required. Ropes can be cut down to make other sizes or sections. (2) Leather beds down to curvature on small pulleys and the minimum size of pulley in use for a rubber Vee rope can be reduced for leather. This is because leather does not bulge. This is a very important point one leading rubber Vee rope maker designs ropes concave at rest so that under curvature the concave sides become straight. (3) Leather can be fed like shoes with a good dressing.

Use of Fasteners

Leather will take a fastener, and several different types of fastener are in use according to the drive and section. Use of a fastener often saves dismantling of a bearing where endless ropes cannot be applied. Alternatively, leather may be jointed on the job and cemented without dismantling of bearings. All joints are cemented with a waterproof plastic which stands up to the bulk of liquids used during milling, grinding and cutting processes.

Leather ropes are practically non-static and are replacing rubber in factories where shell filling is taking place.

With rubber ropes, sometimes in a set of five, four will be under correct tension and one slack. With leather Vee ropes each set is matched so that each rope transmits its own share of power.

FUEL ECONOMY IN THE CHEMICAL INDUSTRY

In order to promote fuel economy in the chemical industry, and as part of the move in this direction initiated by the Trade Association Sub-Committee of the Ministry of Fuel and Power, it has been arranged to hold joint meetings of the A.B.C.M. and the B.C.P.M.A. at each of which two or three short papers are to be presented by chemical engineers on subjects of interest to the chemical industry and dealing specifically with aspects of the subject which would lead to economy in fuel consumption. These meetings are to be held both in London and Manchester, the same papers being presented at each place. This report contains the first of two papers which were presented in London on July 28, and in Manchester on August 25, together with a condensed account of the discussion upon it. The Chairman of the London Meeting was Dr. G. E. Foxwell, Chairman of the B.C.P.M.A., and of the Manchester Meeting, Mr. J. Macgregor, Chairman of the A.B.C.M. Fuel Efficiency Committee in the North-Western area. The second paper follows in next week's issue.

Fuel Efficiency Lectures

I.—Heating by Liquids

by BRIAN N. REAVELL

HEATING by liquids or fluid heat transmission systems are used when relatively high temperatures are needed together with very accurate temperature distribution and control. To make the most efficient use of such systems, it is necessary to understand why they are used and the general principles which are common to all these systems. The commonest ways of heating in chemical process work are: (1) steam heating in tubes or jackets; (2) direct firing with coal, gas or oil; and (3) by live steam. (1) and (3) are sound and practicable for temperatures up to about 180° C. and are adaptable to simple automatic control. Above this temperature there are many snags such as high steam pressures—meaning very costly plant—and low thermal efficiency. With system (2) there is no limit to the temperature that can be obtained, but it is difficult to get even distribution of the temperature and accurate control in all parts of the process.

Intermediary Liquid

Liquids and "condensing gases" give up their heat far more easily than do flue gases so that for many processes requiring temperatures above 180° C. and where accurate temperature control is needed, heating is done by means of an "intermediary" liquid. The intermediary liquid is first heated in a jacketed or tubular device generally called an "absorber." The hot liquid then passes on to the process plant where it is made to give up part of its heat in tubular or jacketed vessels and returns to the absorber to take up a further supply of heat, and so the cycle continues.

In discussing how to get the highest efficiency from such a system it is easiest to consider three separate sections: (a) The prime source of heat and the absorber; (b) the circulatory system whereby the hot liquid is cycled; (c) the abstraction of heat from the circulatory hot liquid. Taking them in this order, (a) can be regarded as a boiler—and most of the principles of efficient boiler firing, whether by coal, gas or oil, will apply to the firing of an absorber. There is, however, one big difference, and a possible danger: whereas careless firing and overtaxing a water boiler may result in damaged tubes, with fluid heating careless firing can damage both the tubes and the circulating liquid. The liquids most commonly used are mineral oils, compounds of diphenyl, and water under pressure. If the two former are overheated cracking and carbonisation will take place with, possibly, immediate disastrous results and certainly leading to a loss of efficiency in future working due to deposition of carbon on the heat transmitting surface. For the same reason in (b), the circulating system, care must be taken to avoid a cessation or reduction of the flow due to faulty pumps or blocked pipes. If the circulation stops, the liquid may become overheated in the absorber with consequent cracking and carbonisation. For the same reason it is very necessary to take care and have patience in starting up the plant when it has been shut down and become cooled. The maximum rate of fluid circulation through the absorber will not be reached until the system is warmed up, so the fire should never be forced until the circulation is up to normal.

To ensure that the circulation rate is not obstructed a periodic check should be made on the air drains on the pipe lines. These should, of course, be situated at the highest point on the system and at any loop of pipe which bends upwards and downwards; an air lock can reduce the circulation rate very materially and so reduce the plant efficiency.

Heat-Extraction Apparatus

Coming now to (c), the point at which heat is extracted, it is hard to generalise, as the apparatus may vary from a simple coil in a tank to a complicated multipass heat exchanger. However, if the question can be

regarded as a simple example of heat transfer through a boundary wall, *i.e.*, heat in the circulatory liquid passing through the metal wall of, say, a jacket into the contents of a pan, clearly the velocity of the circulatory liquid must be kept as high as practicable, and clean and free from deposit, and the inside of the boundary wall, *i.e.*, the pan, must be clean and free from scale and dried-on deposits.

I will not attempt to discuss lagging as it has rightly been given high priority by the M.O.F. and I assume that everyone appreciates the absolute necessity of keeping process plant and pipework properly lagged, but I would point out that when working on fluid heat transmission systems with temperature of, say, 300° C. good lagging is needed even more than on boiler plants—100 ft. of 2 in. pipe working at 300° C. will lose more heat than 400 ft. of 2 in. pipe at 50 lb. per sq. in. or 150° C.

Questions and Answers

After these very sketchy generalisations I will now try to put myself in the place of a plant operator or process man in charge of a fluid heating system and borrowing the accepted style of the Government posters, I will ask myself a few questions and give (I hope) the right answers:—

1. Q. What are the four points to check when the plant is running under normal conditions?

A. (a) Firing of absorber must be right—no belching smoke from the stack—no excess of secondary air—see all the existing Ministry of Fuel Bulletins dealing with boiler firing.

(b) Make sure that pumps are circulating at full rate by reading the inlet and outlet pressure gauges—the difference in readings should be normal.

(c) Check hourly fuel consumption—if the process demand is normal but consumption is creeping up, the cause must be investigated.

(d) Check thermostat and maximum temperature control on circulating fluid—because if a maximum safe temperature is exceeded inefficient working is likely to result and the circulating liquid to be spoiled.

2. Q. If the four points above have been checked and the process men complain of not getting enough heat what should be looked for?

A. Make sure the process men have not allowed scale and dried product to stop the heat from getting through to the product in their pots, pans, vessels, etc. If that is in order, look for by-passing of hot liquor through half-opened or leaking control valves.

3. Q. How can it be determined that the plant is working efficiently?

A. It is known how much fuel per hour is burnt, and this is equivalent to A B.Th.U./hr. It is known that the circulating liquid is leaving the absorber at T_1° C. and entering at T_2°C. The temperature drop is therefore $(T_1 - T_2)$° C. The specific heat is S. The plant makers state that the rate of circulation for this temperature range is P lb. per hour. Hence the plant is using 1.8 $(T_1 - T_2)$S.P. B.Th.U. per hour, so that

$$\text{the overall efficiency} = \frac{1.8(T_1 - T_2)\text{S.P.} \times 100}{A}$$

As an example of the type of oil used and its characteristics, Merrill oil may be taken. The maximum temperature for safe working is 315° C. = 600° F.

The characteristics of the oil are:—

Specific gravity at 60°F.	= 0.914
Flash point, closed	= 575°F.
Flash point, open	= 635°F.
Fire test	= 700°F.
Viscosity—1600 sec. Redwood 1 at 140°F.	

A normal stack temperature for an oil-fired furnace would be 350° C. = 662° F., with an inlet of, say, 280° C. (536° F.) outlet 300° C. (572° F.).

Discussion

The discussion to these papers is given in the form of question and answer, the answers being provided by the lecturer unless otherwise stated.

Q. Can automatic temperature control be applied to these fluid heating systems?

A. Yes. It is nearly always a standard provision.

Q. What type of thermostat should be used and how should the control be effected?

A. The type of thermostat depends on the conditions. For controlling oil temperature where a fairly large motive power is needed, the hydrostatic thermostat is preferred as more robust than the electrical type. The inlet temperature to the process plant is controlled and the quantity of oil circulated through the process plant is varied by use of a by-pass, but the rate at which oil passes through the absorber is retained constant.

There is a minimum speed of passage of fluid through the absorber. If this minimum rate is not maintained the tubes can be carbonised in a few days, but if the velocity is kept high enough they may remain free from carbon for 5 to 10 years.

Q. What is the life of mineral oil in these systems?

A. If the plant is correctly designed and is properly looked after, the oil may remain unchanged for as much as seven years; at a plant where the design was faulty the life was seven days.

Q. In a steam boiler, if too much heat is put in, steam blows at the safety valve. This is waste, but it does no harm to the process or the boiler. If too much heat is put into an absorber the oil is carbonised and grave difficulties result. What precautions are taken to avoid these difficulties?

A. Thermostatic control on the outlet temperature of the absorber governs the rate at which fuel is supplied to the furnace. The design of modern thermostats is exceedingly

good and the lecturer stated that he had never known one to fail.

Q. How can fluid heating be checked if the process involves an exothermic reaction which must be checked by cooling?

Fluid Cooling

A. This problem arises in many industries, *e.g.*, synthetic resin manufacture. The best method is to have a fluid cooling system as well as a fluid heating system. When the heating period is over, the cooling system is brought into play and the temperature of reaction is checked. The heating and cooling liquids are the same, *e.g.*, diphenyl compound or oil, and the two circulatory systems are interconnected by balance pipes. Oil does not lend itself to this scheme below about 50° C. as its viscosity when cold is too high.

Q. In a diphenyl system if the liquid becomes carbonised by long use, does it give rise to any corrosive compounds which might attack the metal in the system?

A. No. Tests have shown that no corrosion is set up even if the diphenyl is very badly overheated or cracked.

Q. Can you strain or filter circulating oil that has been cracked or carbonised by improper use?

A. No. The overheating of the oil and cracking will also reduce the flash point and increase the viscosity so that it is unsafe for further use.

Q. What should be the velocity in jackets or coils when heating with oil?

A. This depends on the type of plant and total heating surface involved but in general not less than 5 ft. per second in a heating jacket or tube.

Q. What precaution should one take against oil leakage in pipework, etc.?

A. Joints must be flanged, not screwed. The flanges are welded and the faces machined. Table "H" flanges should be used even though there are no high pressures in the oil lines. Corrugated metal joint rings and paste joints are preferred.

Q. What is the overall efficiency if working in a jacketed enamel pan at, say, 350° C.? What is the efficiency of the whole system, *e.g.*, what would be the proper exit temperature of the gases from the absorber assuming coal firing? Can the waste heat from the absorber be utilised in the plant itself or must a separate waste heating boiler be employed?

A. The figure depends on the fuel used for firing, but up to 50 per cent. overall efficiency can be expected. For normal economic units it is unlikely that the chimney temperature of the flue gases can be below 450° C. and some use could be made of the waste heat. In a number of installations a small waste-heat-recovery boiler is installed and the steam is used for neighbouring processes. The overall efficiency figure of 50 per cent. is not necessarily the maximum as obviously, if an electrical heating system were employed, the efficiency would approach 100 per cent., though radiation losses must be deducted from this figure. A badly operated hand-fired coal furnace may bring the efficiency down to 30 per cent.

Q. Where should the pump be placed?

A. Normally one should pump direct into the absorber.

Q. What range of loading can be put on the absorber? Would a reasonable efficiency be maintained with variations of between, say, 100 per cent.-50 per cent. or 100 per cent.-25 per cent. loading? The question had specific relation to burning pitch which was required to be maintained at 300° C.

A. Generally in practice the maximum useful range of fluid heating system operates between 80 per cent. and 100 per cent. load. The use of pitch for firing generally entails a ring-main distribution system and is thus analogous to a fluid-heating system.

Q. Is not the problem of range essentially a problem of the ratio of heat capacity of the circulating fluid to that of the furnace brickwork? Electric immersion heaters have practically no heat storage and the load can be varied between 0 and 100 per cent. with immediate response. What is the advantage of liquid heating over direct electrical immersion heating?

Comparison with Immersion Heating

A. The advantage is a practical one rather than a matter of economy:—

(a) Direct electrical immersion heaters are limited by the space available in the pan.

(b) The surface temperature of the heaters must be less than the decomposition temperature of the substance being heated. With milk, for example, this is very low, and so is the rate of heat transfer.

(c) This low rate of heat transfer cannot be compensated by large heating surface as there is insufficient room available.

(d) The limitation of heating surface does not apply to heating coils through which a heating fluid is circulated.

(e) The operating cost of a coal-fired heating system is less than that of an electric immersion system.

(f) The accessibility for cleaning is an important factor.

(g) Where, however, there is no limiting maximum temperature of the heating surface, *e.g.*, in melting lead, direct immersion heating can be used if the cost of electricity will permit.

Q. Since blowing the safety valve of a steam boiler results in waste of steam, is it not highly advantageous to use a system without a safety valve, as in liquid heating?

A. A safety valve gives visual evidence that too much heat is being applied. Overheating in the absorber may cause carbonisation and subsequent trouble unknown to the operator. With many oils there is, however, nasal

evidence in the strong smell of decomposing oil.

Q. If the system is used on a batch process, how long must the emptied vessel be allowed to stand before it can be recharged, in view of the heat capacity of the oil in the heating jacket or coil?

A. This depends on the heat stored in the oil and vessel. On the completion of heating, the heating medium should be passed into another vessel made ready for heating so that the heating system is not running on no load. Staggering production to suit the heat available is greatly conducive to conservation of fuel.

Temperature Limits

Q. Is liquid heating or steam heating best for low temperatures? What is the maximum temperature for liquid heating?

A. Probably 180° C. is the lower limit at which liquid heating would be usefully applied. When used as a circulating fluid, the maximum temperature is 320-370° C. Fluid heating is frequently used below 180°C. for constructional reasons. The lower fluid pressure as compared with steam heating enables the construction of jacketed vessels to be cheaper.

Q. Cannot water under pressure be used with advantage at lower temperatures?

A. Each job must be taken on its merits. Water is cleaner to handle than organic liquids and it does not decompose if the temperatures rise too high. There is no danger of fires with water, but for a given temperature the pressure must be much higher than with the higher boiling liquids.

Q. What is the advantage of circulating water at 300° C. as against using steam from a boiler at 300° C. since the pressures must be the same?

A. This is a matter of economy in the waste heat from the condensate if steam is used.

Q. Why should fluid heating be used, for example, to heat an enamelled jacketed pan to 300° C., instead of direct firing?

A. Firstly, with fluid heating the maximum temperature is controlled and there is no danger of cracking the enamel surface. Secondly, local overheating or "burning" the product in the pan cannot occur. If, however, no trouble is experienced with existing direct firing either in cracking the enamel lining or spoiling the product it is best to carry on with the system under present-day conditions.

Q. What liquid is suggested for heating a product at 300° C.?

A. To some extent it depends on the size and type of apparatus in use, but in general diphenyl compound is recommended because it is stable at this temperature.

Q. Which figure is the more useful to consider in the oil specification, "open" flash point or "closed"?

A. The "open" is the most important.

Q. Does the supervision of such a system entail a lot of labour and hence add to cost of working?

A. No. The labour needed and the amount of routine work involved is no different from any ordinary boiler plant. The absorber house cannot be left unattended any more than can the boiler house, but the attendant only has to watch the temperature and pressure gauges and attend to the firing.

Q. Would it not be better for checking the general performance of the plant to have flow meters in the circulatory system, instead of relying on the pressure differential reading in the absorber?

A. Yes. This is a very good idea but the meters are expensive and in practice, as they are not essential, they are not fitted as standard. The pressure differential gives a really good indication as to what is going on, and if the differential starts to drop it shows that the circulation ratio is below normal and the cause must be investigated at once.

Q. Are there other liquids in use besides mineral oil, diphenyl compounds and water?

A. Yes. In the U.S.A. a mixture of sodium nitrate and nitrite is in use, but this is a relatively new development and we have not sufficient evidence at present to say that this mixture will prove a success over a long period of working. Investigation of other alternative liquids is also being carried out in this country. Melted lead has been used for tar distillation.

Summary

The Chairman then summarised the fuel economy of the discussion: (1) Fuel economy in liquid heating systems is built upon thermostatic control and clean surfaces to give good transmission of heat; hence the instruments must be kept in good order to avoid carbonisation and other troubles consequent upon overheating. (2) The rate of oil circulation must be maintained sufficiently high to avoid overheating and carbonisation. (3) Circulating excessive quantities of oil is wasteful of power, but is not wasteful of fuel otherwise; therefore err on the side of too rapid circulation.

LETTERS TO THE EDITOR

B.B.C. Science

SIR,—Your comments on B.B.C. Science have presented a rather one-sided view of the position. First, with regard to speakers, it should be noted that, although the early talks in the series were not by experts in the particular fields, later the experts begin to have their say. For example, Professor Speakman, last week, presented a most able picture of the textile field, introducing topics which probably had not reached the public in any other way before.

Then there is the attitude of the B.B.C.

to consider. The General Overseas Service and the Pacific Service, for example, have been running regular programmes containing scientific material for a considerable time. The interesting point is the difference in attitude between these services and the Home department. And not only is there a difference in outlook, but also, in general, a different technique used in presenting science. The overseas programme-builders try to make the script as interesting as possible by keeping the talks short, using a compère, and sometimes introducing dramatisation and special effects.

If it is permissible to make generalisations on the basis of sketchy data, one would say that those who plan the Home Service programmes are lacking in imagination, with certain exceptions, and that the authorities to whom they are responsible have not yet appreciated the vital part that science plays in everyday life, and hence they have not made the arrangements necessary to see that it gets its full share of radio time.

Suggestions have been made by various organisations and individuals (the writer among them) that there should be appointed a Science Liaison Officer to the B.B.C. whose task would be to see that the subject gets introduced in the right way, and heard for the right amount of time. This method is used in respect of other broadcasting interests.

At the recent British Association meeting dealing with science publicity, Sir Allan Powell reacted in an apparently favourable manner to the suggestions made there on the above theme. But, if he will pardon the remarks of a fellow-wearer of the old school tie, he seems to have forgotten his promises.

Before closing, I should like to draw your attention to the fact that the film interests represent another problem of scientific exposition.—Yours faithfully,

Sydney Gregory, B.Sc.

October 24, 1943.

Sir,—The most dangerous feature of the *Radio Times* attack on science, to which you refer in your issue of October 23, was the implication that science is concerned with toys; possibly dangerous toys like bombs, or possibly innocuous toys like silk stockings and tobacco, but definitely toys and not contributions towards the progress of humanity. This is what they said on September 17: ". . . the work of scientists, while not necessarily increasing to any great extent the sum total of human happiness in the long run, is quite often of practical benefit to the Smiths in its more immediate results. It may, for example, enable Mr. Smith to smoke better blends of tobacco at a cheaper price, or present Mrs. Smith with an ever-widening range in synthetic silk stockings."

As a result of correspondence attacking this attitude, the *Radio Times* now says (October 15): "We were speaking in parables, of which the purpose, as we understand it, is to use trivialities in order to reveal immensities. 'If even tobacco and stockings, then how much more,', etc., etc."

Whether these "immensities" are, after all, considered to contribute to the sum total of human happiness, I do not know; although the *Radio Times* expresses "sympathy" with my views on the purpose of science, it does not explicitly commit itself to supporting them. But willingness to yield to pressure is not enough. If the B.B.C. can only approach science in this fainthearted way, it is time it had the assistance of someone who understands the spirit and function of science, either as a member of the Board of Governeors of the B.B.C. or through a Science Advisory Committee.—Yours faithfully,

D. A. Bell, M.A., B.Sc.

October 23, 1943.

Russia and Private Enterprise

Sir,—A rather unscientific reference to the Soviet Union in Mr. Neil Fisk's letter, published in your issue of October 23, seems to me to deserve a word or two of comment. A competent authority assures us that the Stakhanovite system constitutes a partial return to the "profit motive"—to use a derogatory Socialist term for the "service motive." In the U.S.S.R., during the past six years, there has been an increasing tendency towards payment by results; all workers, including management and engineers, are given premiums or extra wages for services beyond what is called the "norm"; individual plants are expected to make a profit between 5 per cent. and 30 per cent., which is passed to the Central Government.

In Russia, the State has found that, in order to render the machine less cumbersome, it has to give more scope to personal enterprise than its founders would have previously admitted. This is, of course, only a beginning, but surely, in the light of Russian experience, the American and British democracies will think twice before committing themselves to a State-planned economy and all that it implies. I would suggest that Mr. Fisk is placing the emphasis on the wrong spot.—Yours faithfully,

Deryck Abel.

Sugar production in Brazil for the year ended May 31 amounted to 14,679,524 bags, against 13,851,259 bags for the previous year.

Mr. C. F. Merriam, retiring Chairman of the A.B.C.M.

Association of British Chemical Manufacturers

The Chairman Calls for an Overhaul

THE 27th annual general meeting of the Association of British Chemical Manufacturers was held in London on October 14, with Mr. C. F. Merriam in the chair. In moving the adoption of the annual report and accounts, the chairman did not go through the report in detail as he considered it gave a fairly complete picture of the principle matters that had engaged their attention during the year. He referred first of all to the sad loss they had recently suffered by the death of Mr. Lukes, and paid a public tribute to his 26 years' work in connection with the Traffic Committee.

The Chairman's Speech

"Among the matters referred to in the report," said Mr. Merriam, "is the work of the Fuel Efficiency Committees which have developed largely through the energy and enthusiasm of Mr. Holden. The Association is also indebted to the individual members of the various committees, who have given so much time to this work. It is saisfactory to be able to say that the industry has co-operated with the Ministry of Fuel and Power in a helpful spirit. However, there is still much to be done in this field and I hope members of the Association will continue to give this important subject the attention it deserves.

"During the year the Ministry of Supply approached the A.B.C.M. and other associations connected with the chemical industry in regard to certain post-armistice questions. The Ministry asked for information to help them formulate a short-term policy for the period immediately following a cessation of hostilities. At the invitation of the A.B.C.M., all the bodies concerned met together and agreed to issue a uniform questionnaire to all their members. In addition, a joint meeting was held with the officials of the Ministry of Supply and other Government departments interested, in order to clarify certain doubtful points. I believe I am correct in saying that this was the first occasion on which every trade association connected with the production of chemicals had met the Government as one body, and it was officially welcomed as helpful to the departments concerned and a happy augury for future collaboration. I might add here that I have been told on good authority that the ready response of the Association to the many and constant calls for help from numerous Government departments is greatly appreciated and it is gratifying to know that the Association is to-day held in high repute by the various ministries.

"At our last annual meeting I referred to the question of the organisation of the Association and I suggested that we might have to consider, among other things, whether it was desirable for membership of a trade association, such as our own, to be compulsory for all firms in an industry and also whether such an association should be in a position to enforce its decisions. During the year the views of members on these two points were made quite clear in the course of answering a questionnaire issued by the F.B.I. The great majority were strongly averse to any form of compulsory membership of a trade association, nor did they wish for compulsory powers to be granted.

The Post-War Period

"Plans are well advanced for the setting-up of an Industrial Information Service, which has been referred to in the 'Proceedings of Council.' This is admittedly an experiment, but it is a serious endeavour to contribute towards the general efficiency of the industry. I hope members will take full advantage of this scheme and co-operate to the best of their ability, so that the vast store of useful but non-confidential information and knowledge, which is in the possession of every firm, may be made available to a wider circle for the benefit of our industry.

"During the year we have started a more intensive study of post-war problems, by inviting our Groups and affiliated Associations to submit reports which will enable the Council to appreciate the problems facing the various sections of the chemical industry. Good progress has been made in the compilation of these reports, but only

one of them has reached the stage of formal presentation to the Council. Mr. Pratt, who is still working for the Ministry of Supply, where he has been for more than three years, has been able, since last January, to devote a certain amount of his time to this work.

"I think I am justified in saying that the chemical industry has done, and will continue to do, as much as any industry in the country to help in the national effort to win the war at the earliest possible moment. We, together with other industries, are stimulated to put forth our utmost by that dominating objective, but after the war the position may be different and we may not have the advantage of one common purpose. It has been said, with truth, that the chemical industry is not just one industry, but consists of many industries, and it will not be easy to formulate a policy that will satisfy the needs and aspirations of every section. If, however, after the war the country is fortunate enough to find common and acceptable objectives, both national and international, and if it is prepared to pay the price of achieving them, there will be a good chance of winning the peace. If this happens, it will make our task in the chemical industry rather easier, though we are likely to be confronted with problems even more difficult than those with which we are dealing at the present time.

Control and Competition

"In any case, it is, in my opinion, imperative that each firm in the chemical industry should undertake a thorough overhaul, because we shall ultimately be faced with keen competition from a number of directions. Although we can reasonably expect that the United Nations, for reasons of security, will exercise control over our competitors in enemy countries for a long period, such a control cannot continue for ever and we must not allow ourselves to get into a habit of relying on Government protection to such an extent that we neglect to keep ourselves in a state of the highest efficiency at all times. It appears to me as not beyond the bounds of possibility that if an industry receives special help from the Government in the shape of protective tariffs, import quotas, guaranteed prices, or in other ways, it may expect, in the future, some kind of control or supervision by the Government, in order to make sure that such assistance is not abused, for example, by inertia in the matter of improvement in efficiency.

A few of the problems involved in the necessary overhaul of organisation, the chairman suggested, were the decision as to what plant should be scrapped and what new processes adopted, what additional funds could be allocated to research, what were the possibilities of co-operative research, co-operative marketing, and export marketing methods, and what encouragement should be given to the education of young people wishing to enter the chemical industry and what arrangements should be made for their continued education while engaged in the industry. "We have a particular responsibility laid upon us," concluded Mr. Merriam, "because of the vital services we render to every industry in the country."

On reaching the end of his term as chairman, Mr. Merriam thanked members for their support and expressed special gratitude to the Joint Assistant Managers, Mr. Drake and Mr. Holden. He was sure that his successor could rely on the same generous support.

Points from the Report

Group B of the Association has for many years met only as a full group, with no committee meetings. During the year, an increasing belief that this was too cumbrous a system for a group covering widely different market interests came to a head. Group B committee was authorised to inquire into the workings of the system and make recommendations, and for the better consideration of the matter, the Council authorised the committee (a smaller one than the current membership of the group warranted) to co-opt and thereby become representative. The group committee, enlarged as above, was authorised by Council to act in that form for the remainder of the Association year.

During the year Mr. Duncalfe was compelled to resign the chairmanship of the B.S.I. Chemical Divisional Council. The chairman of the Association was invited by the Institution to fill the vacancy in order to facilitate the progress of the proposals for the reorganisation of the Chemical Division. This reorganisation has now been accepted in principle, and early steps are envisaged for making it operative. Among other changes it involves a substantial alteration in the constitution of the Chemical Divisional by reason of the extension to the Chemical Division of the system of industry committees adopted in other divisions. The new system allows the uniform recognition of the producer organisations, such as the Association, as having the prime interest in any proposals for chemical standards.

The Council of the Association received from the Chemical Council a memorandum envisaging an appeal for further funds. The chairman was asked to select members of a sub-committee to explore the position with representatives of the Chemical Council, and the Chemical Council decided to prepare a fresh memorandum in the light of the joint discussion arising therefrom. This memorandum is at present being considered

by the Council of the Association. Under the constitution of the Chemical Council, two of the Association's representatives (Dr. F. H. Carr and Dr. Vargas Eyre) retired from office during the year, and Dr. A. E. Everest and the general manager were appointed to fill the vacancies. At the invitation of the Chemical Council a fourth representative was appointed and Dr. R. E. Slade, who had previously served as a representative of the Association, was nominated.

The Association secured the addition of certain further continuous chemical processes to the schedule of exemptions in the Unfenced Machinery Regulations of 1938. The Factory Department has clarified the position of benzol and similar stills and fractionating columns, and accepted the view that only when the steam pipes have inlet and outlet connections to headers are the stills to be classed as "steam receivers" for the purposes of periodic inspection under Section 30 of the Act.

Three district committees were set up to co-operate in the Government campaign for fuel efficiency. Following scrutiny of specially prepared returns, suggestions were made to the Regional Committees as to firms likely to welcome assistance. Panels were formed of experts in the utilisation of steam and power in chemical processes, and they have co-operated with Ministry of Fuel engineers in visits to members. The best results have been produced by such personal visits, points of special interest being referred to the district committees. A start has been made with a series of technical discussions designed to increase these mutual interchanges of practical information between members.

The Board of Trade made drastic cuts in the second awards of supplementary coupons for industrial clothing. The Board agreed to make an award for heavy chemical manufacture and the Association co-operated with the Association of Chemical and Allied Employers and Imperial Chemical Industries, Ltd., in the negotiations leading to this decision. The Association was also entrusted by the Board with the operation of a scheme for coupons for clothing destroyed by accidents due to chemical processes.

Council for the Year

The constitution of the Council for the ensuing year will be as follows:—

President: Dr. E. V. Evans, O.B.E., F.I.C.; *Vice-presidents*: Dr. E. F. Armstrong, F.R.S.; Dr. F. H. Carr, C.B.E., F.I.C.; Mr. R. Duncalfe; Mr. C. A. Hill, B.Sc., F.I.C.; Mr. C. F. Merriam; Sir David Milne-Watson, Bt., D.L., LL.D.; Mr. R. G. Perry, C.B.E.; Mr. E. Wallace, C.B.E. *Elected Members*: *Chairman*: Dr. P. C. C. Isherwood, O.B.E.; *Vice-chairman*: Mr. L. P. O'Brien; *Hon. treasurer*: Mr. C. E. Carey. *Members*: Messrs. F. W. Bain, M.C., T. R. G. Bennett, A. E. Everest, G. E. Howard, H. Jephcott, W. F. Lutyens, J. H. Olliver, D. J. W. Orr, F. M. Roberts, K. H. Wilson, W. J. U. Woolcock, C.M.G., C.B.E., and H. Yeoman. The co-opted members, honorary vice-president, general manager, and joint assistant secretaries are unchanged.

NEW AMERICAN GLASS

A new American patent, No. 2,323,684, assigned to the Owens-Corning Fiberglas Corp., permits the waxing of each glass filament as it is drawn out and spinning the filaments into thread or yarn before the wax has had time to harden. The result is a firmer and smoother thread. The filaments are drawn individually from the bath of molten glass, or produced by directing an air blast at a thin stream of the melted substance. In both methods the filaments are passed over a roller carrying a layer of softened wax of relatively high melting point (150° to 170°F.), and afterwards gathered and twisted into a single strand. It is claimed that fibre spun from this material is wholly proof against fire and chemicals.

Another patent, No. 2,326,059, has been taken out by Dr. Nordberg, of the Corning Glass Works. This is for a glass which does not expand and contract with changes in temperature, and is therefore very useful for certain technical uses. Dr Nordberg finds that the addition of 5-11 per cent. titanium oxide produces a glass with an even lower coefficient of expansion than pure fused silica.

SULPHURIC ACID IN BELGIUM

An article on the Belgian sulphuric acid industry recently appeared in the *Brüsseler-Zeitung*. The paper said that at the beginning of the war all imports of raw materials for its manufacture—such as pyrites, blende, lead sulphide and copper ore—were stopped. Before the war the industry made about 800,000 tons a year. Twenty of the factories were equipped with lead chambers, and six of them had contact-process installations that made possible the direct manufacture of arsenic-free acid containing 98 per cent. of monohydrate. After imports were stopped restrictions were placed on the use of sulphuric acid. It could no longer be used, for instance, for the manufacture of synthetic ammonium, sodium and potassium sulphate. To-day its production is concentrated in nine factories. In 1941 some imports of raw materials were allowed, and this has permitted its use to be resumed in the artificial silk industry, for superphosphate production, and for metal dipping.

Germanium in Coal Ash

Chemical and Physical Methods of Determination

THE element germanium was discovered in the rare mineral argyrodite and for many years considered one of the rarest elements. A few years ago, however, a new source of germanium compounds was discovered in coal ash. In particular it was found that the ash of some Russian coals contained up to 1 per cent. of germanium. The analytical methods used by the Russian chemists in their search have been described in detail in two recent issues of *Zavodskaya Laboratoriya* (9, 183 and 271). The chemical method involves four steps—decomposition of the ash, distillation of $GeCl_4$, precipitation of GeS_2, and determination of germanium.

Chemical Methods

The procedure adopted for decomposition depends on whether the ash does or does not contain chlorides. If no chlorides are present, the ash is heated with 50 per cent. H_2SO_4 and 40 per cent. HF till white fumes of H_2SO_4 appear, but not above 300° C. After HF has been completely removed the residue is mixed with water and then with dilute hydrochloric acid, and distilled. If, however, the ash does contain chlorides, it is fused with 7 parts of Na_2O_2, the reaction product is decomposed with water, and enough sulphuric acid is added to the solution as to make it 5N. The solution is saturated with H_2S, left standing for 12 hours, saturated with H_2S, again, and filtered. The precipitate, consisting of GeS_2, As_2S_3, some other sulphides, and sulphur, is dissolved in 10 per cent. NaOH and oxidised with concentrated hydrogen peroxide. The solution is mixed with concentrated hydrochloric acid and distilled.

The solution used for distillation must contain 200-210 gm. of HCl per litre. Some bromine is added to it to oxidise the sulphur, etc. It is kept gently boiling till its volume is reduced to one-half, when the liquid is filled up with HCl (d. 1.095) and distilled again; then a third portion of hydrochloric acid is added and a third distillation carried out. If the ash contains much arsenic, the distillation is performed in a current of chlorine. The bromine in the distillate is reduced with hydroxylamine hydrochloride. The solution is made up to 3-4N as regards H_2SO_4, cooled with ice, and saturated with H_2S. The precipitate is washed with 5-6N H_2SO_4 saturated with H_2S. It still can be contaminated with As_2S_3. If the amount of GeS_2 is relatively large (more than 0.1 per cent. of the ash), it is converted into GeO_2 by heating in a porcelain crucible with nitric acid. Arsenic compounds evaporate and do not interfere. GeO_2 is weighed. If the precipitate of GeS_2 is too small, Ge is determined colorimetrically or precipitated as the hydroxyquinoline salt of the germanium-molybdic acid.

Physical Methods

The physical method is more rapid but it requires a quartz spectrograph; the apparatus used by the Russian chemists was made by Adam Hilger, Ltd., in London. The light source is an arc between carbon electrodes the tips of which are filled with sodium chloride. The distance between the electrodes is 10 ± 1 mm. A germanium spectrum is produced in the arc as follows. A band of tissue paper, 40 cm. by 1 cm., is soaked in 10 per cent. solution of ammonium sulphate, coated after drying with a celluloid solution in amyl acetate, covered with 0.2 gm. of coal ash and 0.005 gm. of bismuth oxide, and fed into the arc at a speed of 10 cm. per min. The part of the spectrum between 2500 and 3000 A.U. is photographed on a plate 10 cm. by 24 cm. It contains the germanium lines 3039.08, 2651.60, and 2651.15, and the adjoining bismuth lines 2993.34 and 2627.93. The intensity of these lines is compared by the photometric examination of the plate, and from the ratio (Ge radiation) : (Bi radiation) the ratio (Ge concentration) : (Bi concentration) is deduced, by means of an empirical calibration curve reproduced in the original paper. The average error of a single determination is ± 8 per cent. of the germanium concentration. It is almost independent of this concentration within the limits 0.01-1 per cent. Variations of the electrode clearance in the ratio 1 : 3 and of the current strength in the arc in the ratio 1 : 1.6 do not raise it. But the precision is lowered if the amount of ash used is reduced to 0.1-0.05 gm.

The intensity of the germanium radiation depends on the chemical nature of the germanium compound present. If the intensity produced by a given amount of germanium in coal ash be taken as unity, the same amount of Ge present as GeO_2 or GeS_2 causes a radiation of 1.6 units. The identity between the radiations of GeO_2 and GeS_2 is due to the reaction $GeS_2 + 3O_2 = GeO_2 + 2SO_2$ taking place in the arc. The radiation produced by Mg_2GeO_4 or by a glass made by melting 1 part of GeO_2 with 9 parts of a laboratory glass is as intense as that of germanium present in the coal ash. This identity makes it probable that germanium is present in the ash as a germanate ad-

(*Continued at foot of p.* 444)

The Canadian Chemical Industry

Now Employing 90,000

INTERESTING details about the Canadian chemical industry are contained in the August Monthly Commercial Letter of the Canadian Bank of Commerce, which points out that chemical factories are now the source of a large proportion of Canadian munitions and other war materials, and are in the front rank of Canadian industrial production as a whole. Canada had a fairly substantial chemical industry in 1939, largely built up during the war of 1914-18, though one deficient in certain products, particularly war chemicals.

Soon after the outbreak of hostilities in 1939 Canada was given the important rôle of chemical reserve for the Allies in case their productivity, especially that of Britain, was curtailed by enemy action. This assignment called for the conversion of some existing Canadian facilities in order to provide for certain new products, but early in 1940 a vast programme of expansion was undertaken, which was accelerated after the entry of the United States into the conflict.

War Chemicals

Security reasons forbid any extensive disclosures of recent outstanding war chemical developments, but the Director-General of the Chemical and Explosives Branch of the Department of Munitions and Supply has furnished the following details of important scientific and productive achievements. A process was introduced at one plant, which has since been adopted in the United States, for approximately doubling the output of T.N.T. from existing facilities. As a result of joint efforts by Canadian and American experts, cellulose from wood pulp has replaced in large measure cotton linters for explosives. A super-explosive of Canadian design has also been brought to a practical stage by Canadian-American co-operation. A Canadian plant for the use of a chemical in the production of high octane aviation fuel was the first established on this continent. A certain type of ammonia derived from domestic natural gas is considered one of the cheapest ammonia products available, while ammonium nitrate originally made for munitions has been used for the production of nitrogen fertiliser.

The chemical industry is now not only a large and vital factor in Canada's armament industry, but has also great peace-time possibilities. Obviously, production of war chemicals will decline markedly when hostilities cease, but it is probable that some at least of the plants can be converted to the processing of products for civilian use, particularly nitrogen fertilisers. The artificial textile fibres and the plastics now made and used extensively, as well as synthetic rubber and high octane spirit, will probably find large peace-time markets, even though the more optimistic of the predictions made for them may not be fully realised. And behind the greatly enlarged chemical industry are vast resources of some of the basic materials most commonly required, principally wood (a source of cellulose, as well as of lignin, the cheapest plastic material yet known), coal, and hydro-electric power.

Comparative figures for chemical production in 1939 and 1942 give a clear indication of the tremendous expansion which has occurred during the war. The output of ten coal-tar distillation plants has increased in value, for instance, from $3,462,590 to $6,805,791. In 1942, there were 30 factories making acids, alkalis and salts, as against 25 plants before the war; the number of employees has grown from 3,080 to 7,564, and the gross value of the products from $23,058,674 to $62,166,895. The value of the output of 25 fertiliser plants (as against 26 in 1939) is over $20,000,000 compared with the figure of $13,177,738. Special war chemicals can only be classified under the nondescript head of "Miscellaneous," and it is here naturally that the greatest expansion is to be seen. In 1939, there were 147 plants producing "miscellaneous" chemicals, with staffs totalling 4197; in 1942, those figures had increased to 178 and 52,548 respectively; the gross value of the products had risen from little over $25,000,000 to $230,400,547.

The aggregate figures for the chemical industry as a whole show that whereas in 1939 there were 797 plants employing 22,288, by 1942 the figures were respectively 869 and 80,101, and the total output had risen from a value of $157,407,059 to $471,797,485.

Some important new projects, notably, a large synthetic rubber plant, have yet to come into full operation. No production data are available for the current year, but a fairly substantial gain is indicated by a rise in the number of employees from 80,000 to over 90,000 between December and May.

(*Continued from p.* 443)

mixture to the silicates. If an ash should be found in which a different germanium compound is preponderant, a new calibration curve may be necessary. A radiation intensity independent of the chemical composition of the original germanium compound is achieved, if to the coal ash on the tissue paper some sodium carbonate is added in addition to Bi_2O_3. The lowest germanium concentration at which Ge radiation can be observed is 0.00015 per cent.

Microanalysis

A Symposium on Microchemical Methods

From a Special Correspondent

FURTHER evidence of the strong interest which is showing itself in this country in specialised methods of chemical analysis was to be found in the large attendance at the exhibition of microchemical apparatus and the symposium on Microchemical Analysis which was held in Sheffield on October 9, under the auspices of the Microchemical Club, the South Yorkshire Section of the Royal Institute of Chemistry, and the Sheffield Metallurgical Association.

The morning was taken up by the exhibition of apparatus. This included apparatus actually in use in the Department of Applied Science, and apparatus lent by a number of the speakers at the symposium and by manufacturers of microchemical apparatus. The analysis of steels absorptiometrically, polarographic and other electrochemical methods of analysis, gas analysis, combustion analysis, and ordinary microvolumetric and micro-gravimetric analysis were all covered by the exhibits, and various functions of the apparatus were demonstrated. In the afternoon the local chairman of the Royal Institute of Chemistry, Mr. E. J. Vaughan, was in the chair, and *résumés* of the papers which were delivered follow.

Metal Alloy Analysis

Some Applications of Absorptiometric Methods to the Microchemical Analysis of Metal Alloys (Mr. C. Whalley). Many problems in steel analysis cannot be solved by the classical macro techniques, primarily because of the small size of the samples available. Investigation showed that the most suitable micro methods to apply were either absorptiometric or polarographic, and since a Spekker photo-electric absorptiometer was available, methods which would utilise it were used as the starting point. The first stage, that of cutting out interference between metals, was successfully accomplished by the use of filters and the introduction of different methods, and the methods were then adapted to the micro scale. In this process several of the methods failed, and had to be replaced by specially devised ones. While carbon and sulphur are still estimated by a combustion technique, nine other alloying elements can now be estimated absorptiometrically with a higher accuracy than is possible when using classical technique, and some attention has also been paid to the problem of aluminium alloys, in which it is now possible to determine iron, copper, nickel, and manganese with the aid of the Spekker. Comparison of the results on test steels shows that they compare favourably with the older methods using large quantities, and further work is in progress to increase even further the advantages to be gained from the microtechnique.

Review of Methods for Micro-Titration (Dr. G. H. Wyatt). This paper was largely illustrated by lantern slides illustrating the various types of graduated flasks, burettes, pipettes, and titration vessels available to the micro-analyst. It was pointed out that in such a short time it was possible to deal with only a very few of the many pieces of volumetric apparatus which have been proposed and which have proved themselves useful in general or special cases. A number of pieces of apparatus described had been on view at the exhibition during the morning.

Polarography

Microanalysis with the Polarograph (Mr. J. T. Stock). It is possible to carry out simple preliminary investigation work on polarography without the use of very expensive apparatus, if a suitable galvanometer is used. Naturally, recording apparatus, which has many advantages if it is discovered that the problem is really suited to polarographic investigation, is somewhat more expensive. The polarograph has proved its usefulness in both inorganic and organic estimations, and a new field has recently been opened up in the form of amperometric titrations, which can be applied to a variety of estimations using quite simple apparatus.

The Use of Mercury Oxycyanide as a Microchemical Reagent (Mr. G. Ingram). This reagent, first proposed by Viebock for the estimation of halogens, has now been shown to have a variety of other uses. It has been applied successfully to the determination of sulphur, halogens, and alkoxy groups, and its use is fairly free from difficulties, since it depends on the fact that alkali is liberated from the reagent. This alkali is then determined by titration.

A Rapid Method of Micro Gas Analysis (Mr. W. B. Price). This paper dealt with the methods that have been developed to analyse minute bubbles of gas enclosed in glass, and the apparatus had been on view earlier, at the exhibition. Using special techniques for handling the samples, and measurement by means of a microscope, it is possible to carry out a complete analysis for hydrogen sulphide, carbon dioxide, oxygen, carbon monoxide, hydrogen, and nitrogen, in an hour, on bubbles of gas of a diameter around 0.2 mm. This technique is

an excellent example of the solution by microchemical methods of a problem in a way which a few years ago would have been scouted as completely impossible.

The Teaching of Microchemistry (Dr. Cecil L. Wilson). Microchemistry nowadays should be recognised as covering a very wide field, of which the present meeting represented a very small part. It is quite possible to teach many of the techniques of microchemistry to students, and the students derive many advantages from this. It should be possible for everyone nowadays to attend a course, equivalent to six weeks, in general microchemistry; and refresher courses dealing with more specialised branches, and completely up-to-date, should also be available. A specimen general course would include both qualitative and quantitative organic and inorganic techniques, as well as spectrography and chemical microscopy.

The Future of Microchemistry

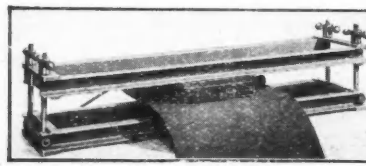
After the papers had been read, the meeting proceeded to discuss at some length the present position of microchemical organisation. Several speakers strongly suggested that every step should be taken, by means of efficient organisation, to improve the position of microchemistry in this country; and it was pointed out that at the moment the position in America is far in advance of that here, and shows every sign of continuing to be so. In view of the keen interest shown in this meeting, it was felt that every effort should be made to awaken similar interest throughout the country. To this end the meeting elected a committee to investigate the present position and possible improvements of it.

PLASTIC TREATMENT OF CASTINGS

Since the appearance of our article on "The Salvage of Porous Castings" in our issue of July 3, Commercial Structures, Ltd., who operate the Bakelite plastic treatment process, have received approximately 1000 castings for treatment at their Leyton works. They have achieved a high proportion of successes; practically the only failures are due to insufficient care being taken by the owner to blank off the casting properly, so that it is not possible to apply the requisite pressure. Owners of castings, should, therefore, bear in mind that the joints must withstand a higher pressure than the test pressure specified. In all cases it is desirable that the joints withstand a minimum of 2000 lb./sq. in., even when the test pressure is below that figure. All apertures except the single ¼ in. B.S.P. tapped hole needed for the reception of the plastic fluid should be blanked off accordingly. With proper care in this respect, the proportion of castings which have been successfully treated is as high as 95 per cent. The offer made by Commercial Structures, Ltd., to treat castings within the limits of their own plant is still open, and they are also able to supply the necessary apparatus, should any firms desire to operate the process at their own works.

REPAIRING CONVEYOR BELTS

What are the ideal requirements of a repairing method to deal effectively with damaged conveyor belts? Probably the most important is that the repair must be



The Ultric Belt Vulcaniser.

as strong as the original material. The repair must also have the essential characteristics of the belt, in particular, flexibility, surface-smoothness and permanence. Further, the process of repair should be simple enough to be within the capacity of any mechanic without special skill or training, and should be available at any time when the belt is idle without the necessity of dismantling the plant.

All these points have been recently emphasised by the designer of the new Ultric Conveyor Belt Vulcaniser, an automatic electrically-operated appliance, which it is claimed, meets every one of these requirements. By the adoption of low temperature vulcanising, the characteristics of the belt are in no way impaired. Further particulars may be obtained from Kautex (Plastics), Ltd., Elstree Way, Elstree, Herts.

ALUMINA FROM CLAY

The National Academy of Sciences in the United States has just completed a year's study on bauxite reduction and has recommended the adoption of a new process in which an appreciable quantity of clay may be admixed with the bauxite. In addition, tailings from the Bayer process may be used. They contain iron, titanium, silica, etc., and are worked by a recently developed sintering process which permits of a high silica recovery. It can also be used to produce alumina from high-silica bauxite. In all, there are several processes by which alumina may be produced directly from clay. Of these the American committee favour the Pederson process and it is hoped that a test plant will be constructed shortly.

Acid from Pickling Liquors*

The Use of Acetone in Recovery

NUMEROUS processes have been devised for the recovery of acid from spent pickling liquors. They were reviewed by Hodge (*Ind. Eng. Chem.*, 1939, *31*, 1364) in his summary on acid wastes. Most of these processes consist of separating ferrous sulphate from the liquor by crystallisation brought about by evaporation and cooling. Many types of operating techniques were developed to separate the maximum quantity of copperas. The best of these processes left considerable copperas in solution and hence did not prove attractive to industry. A process patented by de Lattre (B.P. 491,640-1938) differed markedly from the others in that methanol was employed to produce crystallisation. The alcohol was recovered by distillation and the recovered acid made up to strength and returned to the pickling vats. The crystalline copperas was dried and stored. This process seemed to lend itself to improvement through the possible use of solvents now available at relatively low cost. Preliminary experiments were made in which the relative effectiveness of several alcohols and ketones for promoting crystallisation of the copperas was determined. Of the several solvents employed, acetone proved most effective. When added in sufficient volume, the copperas could be rapidly separated to a high degree from spent liquor. The results obtained appeared to justify further study of this method of treatment.

The first liquor studied was of the batch type and had the following percentage analysis: ferrous sulphate 15.75, sulphuric acid 4.88, water 79.37. The treatment consisted of adding 250 ml. of the liquor slowly to a measured volume of acetone which was constantly agitated at a high rate. The liquor containing the crystals was then vacuum-filtered, pressed, and washed with 10 ml. of acetone on the filter to displace acid filtrate. The filtrate was passed through a packed and heated rectifying column which delivered almost water-free acetone at the top and acetone-free acid at the bottom. The recovered acid was analysed for free acid and copperas content.

A series of five 250-ml. samples were treated by this method, using 100, 200, 300, 400, and 500 ml. of acetone. The percentages of acid and ferrous sulphate in the recovered liquors are shown in Fig. 1. These curves show that optimum results, in terms of copperas removal, were obtained when 400 ml. of acetone were employed, the concentration of ferrous sulphate dropping from 15.75 to slighly under 1 per cent. Acid concentration, due to loss of water with the crystallised salt, reached a maximum of 8.36 per cent. when 250 ml. of acetone were

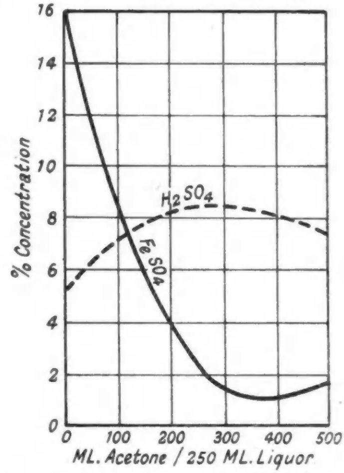


Fig. 1.—Acid and copperas concentrations produced by treating batch pickling liquor with acetone.

used. The ferrous sulphate content of this recovered liquor was 2.45 per cent. The above concentration of ferrous sulphate would be again reduced on the addition of make-up acid and water. Since no great difference existed between the acid concentrations when 250 or 400 ml. of acetone were used, and the ferrous sulphate content of the recovered liquors was low in each case, the volumes of 250 ml. of liquor to 250 ml. of acetone or a 1 to 1 ratio was selected for further study of this process.

An effort was made to reduce the ferrous sulphate content of the recovered acid still further by adding make-up acid prior to acetone treatment. Sufficient concentrated sulphuric acid was added to a sample of liquor to raise the acid to 10 per cent. This sample was treated with an equal volume of acetone in the manner previously described. The ferrous sulphate content of the recovered acid was determined and found to be 2.46 per cent. This was practically the same as that found in similarly treated liquor to which make-up acid had not been added.

Treatment similar to that applied to batch

* From a paper by H. W. Gehm, New Jersey Agricultural Experiment Station, presented at the 105th meeting of the American Chemical Society in Detroit (*Ind. Eng. Chem.*, 1943, **35**, 1003).

liquor was tried for liquor from continuous pickling process. This liquor had the following percentage analysis: ferrous sulphate 7.88, sulphuric acid 10.00, water 82.12 (by difference). A series of tests was made by treating 250-ml. samples of liquor with 50, 100, 250, 325, and 400 ml. of acetone, respectively. Acid and ferrous sulphate concentrations were determined in the recovered liquors. Results of this treatment are shown in Fig. 2. Optimum treatment was obtained when 400 ml. of acetone were employed. This treatment reduced the ferrous sulphate content from 7.88 to 2.3 per cent. and increased the acid concentration from 10 to 11.8 per cent.

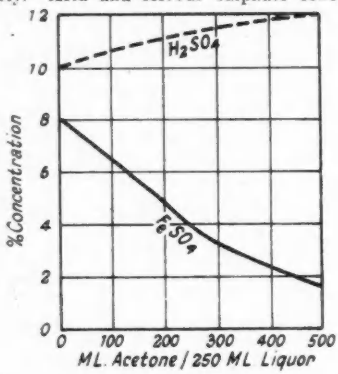


Fig. 2.—Acid and copperas concentrations produced by treating continuous-process pickling liquor with acetone.

Experimentation revealed that acetone was superior to the fatty alcohols for promoting crystallisation of copperas from spent pickling liquors. Batch liquor was best treated with an equal volume of acetone, producing 85 per cent. removal of ferrous sulphate and an increase in acid concentration of 71 per cent. From 1000 gallons of this waste treated, 680 gallons of acid would be recovered. When brought up to the original 15 per cent. acid concentration and volume, with strong acid for re-use, the ferrous sulphate concentration could be reduced to as low as 1.6 per cent. For such a process to operate economically, high acetone recovery would be necessary. In the laboratory experiments 97 per cent. recovery was obtained in an open system. Large-scale closed-system operation of such a process should realise reqoveries well over 99 per cent. The copperas obtained from this process was free of acid and in a relatively dry state. In this form it could be dumped, or marketed if possible.

Efforts to improve the separation of copperas by pre-addition of make-up acid were without success. It is possible, however, that the quantity of acetone required to give similar results to equal volume addition could be reduced if make-up acid was added prior to treatment. Spent liquor from the continuous pickling process could be treated to produce considerable reduction in ferrous sulphate content. Volumes of acetone almost twice that of the liquor were required, and only a small concentration of acid resulted. This occurred because the ferrous sulphate concentration in this liquor was too low to remove much water as water of crystallisation.

General News—From Week to Week

Owing to the indisposition of Sir Harold Hartley, the Royal Society's Lavoisier Bicentenary lecture arranged for November 4 has been indefinitely postponed.

During this month workers in 488 firms and organisations have joined the Red Cross Penny-a-Week Fund. Employees of more than 44,000 firms are now contributing regularly each week.

A "Paint Centre," with aims similar to those of the well-known Building Centre in London, is to be established as a limited company. It is proposed to raise the capital, amounting to £10,000, by means of £10 shares, which will be issued only to members of the Paint Manufacturers and Allied Trades Association.

The British Laboratory Ware Association announces the following appointments: Chairman, Mr. H. J. Hornby; vice-chairman, Mr. Standley Belcher; other members of the committee, Messrs. H. G. Jarrom, J. D. Tatlock, H. A. C. Trepte, A. L. S. Wood. The secretary is Mr. H. F. Kirby. A technical committee has also been formed recently

Foreign News

Owing to the considerable profits which have accrued from the production of mint-oil and the manufacture of menthol therefrom, the industry is to be considerably developed in the Brazilian State of S. Paulo.

The Rio de Janeiro Gas Company is to instal, as soon as possible, complete plant for producing benzol, toluol, naphthalene and other by-products, as well as a small special factory for distilling and experimenting with home-produced combustibles such as coal, shale, lignite, etc.

Personal Notes

MR. J. M. LEONARD has been presented with an inscribed gold match case in recognition of his services as hon. secretary of the Chemical Engineering Group of the Society of Chemical Industry from 1934 to 1942. The presentation was made by Mr. S. J. Tungay, chairman of the group.

The chemical industry cannot, apparently, claim any direct connection with WING-COMMANDER ADRIAN WARBURTON, D.S.O., D.F.C., as was indicated in our issue of October 16. MR. R. A. WARBURTON has written to say that Wing-Commander Warburton is certainly not his nephew, although it is not beyond the bounds of possibility that they may be related. We very much regret that the error should have arisen.

Few changes are reported in the constitution of the Council of the Association of British Chemical Manufacturers for the coming year. DR. E. V. EVANS, O.B.E., is appointed president in succession to MR. R. DUNCALFE, who takes Dr. Evans's place among the vice-presidents. MR. C. F. MERRIAM, last year's chairman, is also appointed vice-president. Among the elected members, DR. P. C. C. ISHERWOOD, O.B.E., becomes chairman in place of Mr. Merriam, and MR. H. YEOMAN becomes a member of Council in place of MR. L. P. O'BRIEN, who has succeeded Dr. Isherwood in the position of vice-chairman. A report of the meeting appears on p. 440.

The following have passed the examination for the Fellowship of the Royal Institute of Chemistry: in Organic Chemistry, MR. KENNETH BOWDEN; in the Chemistry (including Microscopy) of Food and Drugs, and of Water, MESSRS. J. A. BEARDALL, H. F. W. KIRKPATRICK, T. W. LOVETT, J. H. SINGER; in Industrial Chemistry, with special reference to Paper Technology, MR. FRANK BRIDGE; in General Analytical Chemistry, MESSRS. W. T. ELWELL, FRED HUDSWELL; in Metallurgy and the Analysis of Iron and Steel, MR. K. C. BARRACLOUGH. In the examination in general chemistry for the Associateship, 31 candidates were successful.

Obituary

MR. HARRY POOLE, a well-known figure in the borax industry, died suddenly on October 18 while travelling home from his works at Bootle. The business of G. H. Poole & Son, borax and boric-acid refiners, was established by his father in 1885. Since 1929, the late Mr. Harry Poole had been associated with "Three Elephant" brand interests.

The death is announced of MR. J. LUKES, traffic secretary of the Association of British Chemical Manufacturers, after a serious illness of some months' duration. This terminates a twenty-six years' connection with the Association's traffic committee, first as chairman and later as secretary. In his speech at the annual general meeting, the chairman of the Association, Mr. C. F. Merriam, paid a tribute to the willing and valuable service that Mr. Lukes had given to his own committee and to the Council in general.

New Control Orders

Export of Chemicals, Asbestos Goods, Essences, etc.

UNDER the Export of Goods (Control) (No. 8) Order, 1943 (S. R. & O. 1943, No. 1476) which comes into force on November 8, control is extended to cover asbestos manufactures; manufactures of vulcanised fibre; additional metal goods and machinery; chemicals, including benzidine, benzidine hydrochloride, parahydroxydiphenyl; and propionic acid and its salts and esters; and certain colouring matter and flavouring essences made wholly or partly of sugar, molasses, glucose, or caramel.

The existing control in respect of non-ferrous metals and alloys thereof has been extended to cover the specified forms when coated, plated, drilled or punched, and to include pipe and tube fittings and wire spirals.

The existing licensing requirements with respect to certain goods have been modified as under: (a) the item relating to refractory blocks, bricks and tiles has been replaced by the item "refractory blocks, bricks and tiles, wholly or mainly of one or more of the following: chromite, dolomite, magnesite, silica"; (b) the item relating to vulcanised fibre has been replaced by the item "vulcanised fibre and manufactures wholly or mainly of vulcanised fibre"; (c) the item relating to ceramic components has been replaced by the item "ceramic components made wholly or mainly of soapstone, steatite, or titanium dioxide"; and (d) the item peptone and its preparations has been replaced by the item "peptones and their preparations."

The Order also adds Cyrenaica, Saudi Arabia and Tripolitania to the list of countries and territories to which the export of *all* goods is controlled.

Synthetic rubber is a failure when used for making rubber rings for bottling fruit. This opinion of Canadian housewives is based on wide experience, which has led to the Consumers' Council making a protest direct to the Dominion government.

Prices of British Chemical Products

FIRM price conditions continue to be reported from all sections of the industrial chemicals market in London, and the movement to the main consuming industries covers good volumes. There has also been a fair inquiry for new business during the past week, but the supply position, on the whole, shows no material alteration. In both the potash products and soda products sections the demand is strong with deliveries under contracts proceeding along steady lines. Elsewhere, formaldehyde, acetone and arsenic continue in good request and amongst the acids acetic, oxalic, citric and tartaric are in steady call, with offers quickly absorbed. Trade in the coal-tar products is fairly steady, the market being mostly concerned with contract deliveries. Pitch is well held while business in pyridine is still only moderate.

MANCHESTER.—Generally strong price conditions are reported in most sections of the Manchester chemical market, though there has been little actual change of consequence during the past week. As well as the textile and allied trades, most industrial users of heavy chemicals in the district are maintaining a steady flow of delivery specifications, and although at the moment no big weight of new business is being placed locally, replacement orders are coming through steadily as the need arises. In the market for tar products the light as well as most of the heavy classes are moving steadily into consumption.

GLASGOW.—In the Scottish heavy chemical trade there has been an improvement during the past week for home business. Export trade remains rather limited. Prices remain firm with no actual changes to report.

Price Changes

Rises: Ammonium sulphate; caustic potash.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton £39 10s.; 10 cwt./1 ton, £40 10s., 4/10 cwt., £41 10s.; 80% pure, 1 ton, £41 10s.; 10 cwt./1 ton, £42 10s.; 4/10 cwt., £43 10s.; commercial glacial, 1 ton, £49; 10 cwt./1 ton, £50; 4/10 cwt., £51; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r.

Aluminium Sulphate.—£11 10s. to £11 15s. per ton d/d.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Carbonate.—£38 per ton d/d in 5 cwt. casks.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Antimony Oxide.—£111 to £117 per ton.

Arsenic.—For 1-ton lots, £42 to £45 per ton, according to quality, ex store. Intermediate prices for intervening quantities.

Barium Carbonate.—MANCHESTER: precip., 4-ton lots, £16 per ton d/d; 2-ton lots, £16 5s. per ton.

Barium Chloride.—98/100%, prime white crystals, £16 10s. to £19 10s. per ton, bag packing, ex works.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax, Commercial.—Granulated, £31 10s.; crystals, £32 10s.; powdered, £33; extra fine powder, £34; B.P. crystals £40 10s.; powdered, £41; extra fine, £42 per ton for ton-lots, in free 1-cwt. bags, carriage paid in Great Britain. Borax Glass, lump, £83; powder, £84 per ton in tin-lined cases for home trade only, packages free, carriage paid.

Boric Acid.—Commercial, granulated, £52 15s.; crystals, £53 15s.; powdered, £54 15s.; extra fine powder, £56 15s.; B.P. crystals, £61 15s.; powdered, £62 15s.; extra fine powdered, £64 15s. per ton for ton lots in free 1-cwt. bags, carriage paid in Great Britain.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£10 10s. to £14 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅛d. per lb.

Chromic Acid.—1s. 5d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Oxide.—Black, powdered, about £100 per ton.

Copper Sulphate.—£31 10s. per ton, f.o.b., less 2 per cent. in 2 cwt. bags.

Cream of Tartar.—£100%, £13 2s. per cwt., less 2½%, d/d in sellers' returnable casks.

Formaldehyde.—£25 to £26 10s. per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £47 per ton for ton lots, carriage paid; smaller parcels quoted up to 50s. per cwt., ex store.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 11d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Lactic Acid.—Pale tech., £49 per ton; dark tech., 43½% by weight, £42 per ton ex works; barrels returnable carriage paid.

Lead Acetate.—White, 50s. 6d. to 52s. 6d. per cwt. MANCHESTER: £51 to £54 per ton.

Lead Nitrate.—About £47 per ton d/d in casks.

Lead, Red.—English, 5/10 cwt., £44 10s. per ton; 10 cwt. to 1 ton, £44 5s.; 1/2 tons, £44; 2/5 tons, £43 10s.; 5/20 tons, £43; 20/100 tons, £42 10s.; over 100 tons, £42 per ton, less 2½%, carriage paid, non-setting red lead, 10s. per ton dearer in each case.

Lead, White.—Dry English, less than 5 tons, £57; 5/15 tons, £53; 15/25 tons, £52 10s.; 25/50 tons, £52; 50/200 tons, £51 10s. per ton; less 5%, carriage paid. Ground in oil, English, 1/5 cwt., £69; 5/10 cwt., £68; 10 cwt. to 1 ton, £67 10s.; 1/2 tons, £66; 2/5 tons, £65; 5/10 tons., £63; 10/15 tons, £62; 15/25 tons, £61; 50/100 tons, £60 10s. per ton, less 5% carriage paid.

Litharge.—1 to 2 tons, £44 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £18 15s. to £22 15s. per ton.

Magnesium Chloride.—Solid (ex wharf), £16 to £18 per ton. MANCHESTER: £15 to £17 per ton.

Magnesium Sulphate.—Nominal.

Mercury Products.—Controlled price for 1-cwt. quantities: Bichloride powder, 15s. 8d.; bichloride lump, 16s. 3d.; mercury oxide, red cryst., 20s. 9d.; red levig., 20s. 3d.; red tech., 19s. 11d.; yellow levig., 20s. 2d.; yellow tech., 19s. 7d.; sulphide, red, 17s. 9d.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 2s. 4d. per gal.; pyridinised 64° O.P. 100 gals., 2s. 5d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£60 to £65 per ton for ton lots, carriage paid, in 5-cwt. casks; smaller parcels would be dearer; deliveries slow.

Paraffin Wax.—Nominal.

Potash, Caustic.—Basic price for 50-100 ton lots. Solid, 88/92%, commercial grade, £55 7s. 6d. per ton, c.i.f. U.K. port, duty paid. Broken, £5 extra; flake, £7 10s. extra; powder, £10 extra per ton. Spot delivery, ex store, £3 10s. per ton extra. Liquid, d/d, £34 in lots of 1 ton.

Potassium Bichromate.—Crystals and granular, 7⅞d. per lb.; ground, 8⅞d. per lb., for not less than 6 cwt.; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Basic price for 50 to 100 ton lots; calcined, 98/100%, £66 15s. to £68 5s. per ton ex store. Smaller quantities subject to additions to basic price. Spot delivery ex warehouse £3 10s. per ton extra.

Potassium Chlorate.—Imported powder and crystals, nominal

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 10d. per lb. for 1 cwt. lots; for 3 cwt. and upwards, 1s. 9½d. per lb.; technical, £7 18s. 6d. to £8 10s. 6d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, 5 cwt. to 7 cwt., casks, 1s. 6d. per lb., d/d; supplies scarce.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d station.

Sodium Acetate.—£41 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6¼d. per lb.; anhydrous, 6¾d. per lb., net, d/d U.K.

Sodium Bisulphite Powder.—60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£21 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £42 per ton, nominal.

Sodium Hyposulphite.—Pea crystals, £21 10s. per ton for 2-ton lots; commercial, £15 per ton.

Sodium Iodide.—B.P., for not less than 28 lb., 9s. 11d. per lb., for not less than 7 lb., 13s. 1d. per lb.

Sodium Metasilicate.—£16 per ton, d/d U.K. in 1-ton lots.

Sodium Nitrite.—£20 to £23 10s. per ton for ton lots.

Sodium Percarbonate.—21½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 to £28 10s. per ton d/d for ton lots. Tri-sodium, £26 to £30 per ton d/d for ton lots.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salts).—£4 10s. ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £18 5s. per ton, d/d, in drums; crystals, 30/32%, £12 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton, for quantities of not less than 4 tons; ground, but not sieved, £15 10s.; ground and sieved, £17 15s. Controlled prices.

Sulphuric Acid.—168° Tw., £6 10s. to £7 10s. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—3s. 1½d. per lb., less 5%, carriage paid for lots of 5 cwt. and upwards.

Tin Oxide.—Snow-white, controlled material, about 330s. per cwt.; free (nominal), 400s.-500s. per cwt.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £34; green seal, £33; red seal, £31 10s.

Zinc Sulphate.—Tech., £20-£21 per ton, carriage paid, casks free.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 2d. to 2s. 1½d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Bisulphide.—£34 per ton, according to quality, in free returnable drums.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s. ped lb.

India-rubber Substitutes.—White, 6 3/16d. to 10½d. per lb.; dark, 6 3/16d. to 6 15/16d. per lb.

Lithopone.—30%, £25 per ton; 60%, £31 to £32 per ton. Imported material would be dearer.

Mineral, Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Plus 5% War Charge.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosporic acid, per ton d/d farmer's nearest station, in November, £20 5s. Increased charge of 2s. 6d. per month up to March, 1944.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, November, £9 16s.; increased charge of 1s. 6d. per month up to March, 1944.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, in November I.C.I. type "Special No. 1," £14 11s. 6d. Increased charge of 2s. 6d. per month up to March, 1944. Type "Special No. 2," none available until January, 1944.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £15 5s. per ton; granulated, over 98%, £14 10s per ton. None available until January, 1944.

Coal Tar Products

Benzol.—Crude, 60's, 1s. 11d.; pure, 2s. 6d., per gal., ex works.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. to 4s. 6d., according to specification. MANCHESTER: Crystals, 9¾d. to 11½d. per lb., d/d; crude, 4s. o 4s. 6d., naked, at works.

Creosote.—Home trade, 6½d. to 7d. per gal., f.o.r., maker's works. MANCHESTER: 6½d. to 9d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. MANCHESTER: Pale, 99/100%, 4s. 6d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 8d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 2d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, in 4-ton lots, in sellers' bags, £5 9s. to £8 9s. per ton, according to m.p.; hot-pressed, £10 5s. per ton, in bulk ex works; purified crystals, £19 to £35 per ton. Controlled prices.

Pitch.—Medium, soft, 46s. to 55s. per ton, f.o.b. MANCHESTER: 46s. per ton, at works.

Pyridine.—90/140°, 18s. to 18s. 6d. per gal.; 90/160°, 14s. MANCHESTER: 14s. to 18s. 6d. per gal.

Toluol.—Pure, 2s. 7½d. nominal; 90's, 1s. 11d. per gal. MANCHESTER: Pure, 2s. 7½d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 1½d. to 3s. 4d. per gal., according to grade, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Wood Distillation Products

Calcium Acetate.—Brown, £21 per ton; grey, £24. MANCHESTER: Grey, £24 to £25 per ton.

Methyl Acetone.—40/50%, £56 per ton.

Wood Creosote.—Unrefined, about 2s. per gal., according to boiling range.

Wood Naphtha, Miscible.—4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. per gal.

Wood Tar.—£5 per ton.

Intermediates and Dyes (Prices Nominal)

m-**Cresol** 98/100%.—Nominal.

o-**Cresol** 30/31° C.—Nominal.

p-**Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

p-**Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

p-**Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—October 27.—For the period ending October 30, per ton, naked, ex mill. works or refinery, and subject to additional charges according to package and location of supplies: LINSEED OIL, crude, £50. RAPESEED OIL, crude, £60. COTTONSEED OIL, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised, £58. COCONUT OIL, crude, £49; refined deodorised, £49. PALM KERNEL OIL, crude, £48 10s.; refined deodorised, £49; refined hardened deodorised, £53. PALM OIL, refined deodorised, £55; refined hardened deodorised, £58. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £58. WHALE OIL, crude hardened, 42 deg., £51 10s.; refined hardened, 46/48 deg., £52 10s. ACID OILS—Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. ROSIN, 30s. 6d. to 45s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

ANTIGEN LABORATORIES, LTD., London, W. (M., 30/10/43.)—October 11, £2500 debentures, to Mrs. B. M. Morgan, London, general charge.

Company News

Babcock & Wilcox, Ltd., are again paying an interim ordinary dividend of 4 per cent.

Yorkshire Tar Distillers, Ltd., have increased their nominal capital beyond the registered capital of £700,000 by the addition of £50,000 in £1 ordinary shares.

Murex, Ltd., announce a trading profit, for the year ended June 30, of £488,990 (£598,707), but the ordinary dividend is maintained at 20 per cent., including a 2½ per cent. bonus, the net profit having declined only from £201,944 to £193,007. Forward, £119,597 (£115,339). Murex Welding Processes, Ltd., the wholly-owned subsidiary, has shown further considerable expansion during the year.

New Companies Registered

Guardian (Industrial Finishes) Corporation, Ltd. (383,384).—Private company. Capital: £2000 in 2000 shares of £1 each. Manufacturers, exporters, importers and distributors of and dealers in paints, varnishes, oils, colours, distempers, etc. Subscribers: L. F. Gould; H. H. Thornborough, 26 Gainsborough Court, N.12.

Chemical and Allied Stocks and Shares

OWING to continued inactivity in the stock and share markets, movements in security values have shown a slightly reactionary trend. There was again little selling, but markets were dominated mainly by the small demand in evidence. Sentiment continued to be influenced more by the disposition to await results of the Three-Power Conference in Moscow than by the excellent war news.

At the time of writing, Lever & Unilever remained steady at 37s.; Lever N.V. at 34s. 4½d. were also the same as a week ago. Imperial Chemical (38s. 3d.) were within 1½d. of the level of a week ago, and the 7 per cent. preference were again 34s. 6d. Borax Consolidated eased to 36s. 6d. and Murex ordinary reacted further from 101s. 3d. to 100s. General Refractories moved back to 16s. 7½d. There was a further small improvement in Imperial Smelting to 15s. 7½d., it being hoped that the forthcoming results of the last-named company will show that a better trend in earnings has continued. B. Laporte were again 80s., and British Drug Houses improved to 25s. While awaiting the dividend announcement, Burt Boulton remained at 20s. Turner & Newall eased to 77s. 6d. The units of the Distillers Co. were 88s. 9d. compared with 89s. 3d. United Molasses at 31s. 1½d., and British Oxygen at 78s. 3d., reflected the prevailing trend to slightly lower values owing to inactive market conditions. There was again a fair amount of attention given to plastics. Thomas De La Rue advanced to 176s. 3d., which compared with 166s. 3d. a week ago; rumours of splitting these £1 shares into a lower denomination have been current. Erinoid 5s. shares kept at 11s. 6d. on further consideration of the financial results, while British Industrial 2s. ordinary were 7s. 3d. Most shares of companies connected with plastics are valued on a small-yield basis because of assumptions as to the scope for expansion in the industry. It is realised, however, that in most cases, owing to the effect of E.P.T., there will be little likelihood of any strong upward movement in dividend payments until after the war.

In view of the prevailing tendency and absence of improvement in demand, iron, steel and kindred shares moved slightly lower. Compared with a week ago, Dorman Long have reacted further from 30s. 3d. to 29s., and Stewarts & Lloyds were 52s. 3d., compared with 52s. 9d. a week ago. Tube Investments were firmly held and quoted at 92s. 9d., maintenance of the dividend having been in accordance with general expectations. Following an earlier decline, Staveley shares showed a partial rally to 52s. 3d., and Consett 6s. 8d. ordinary had a firmer appearance at 7s. 10½d. United Steel at 24s. 9d. were little changed on balance; the general impression is that the company's profits are struck on a conservative basis, and that there are reasonable prospects of the dividend remaining at 8 per cent. for the duration of the war. Babcock & Wilcox showed a firm tendency at 48s. 3d. xd., and Richard Thomas 6s. 8d. shares were maintained at 10s. 6d.

Coultaulds moved back from 53s. 3d. to 52s. 6d. British Celanese maintained a relatively steady appearance around 31s. 3d., awaiting the financial results. Associated Cement reacted from 65s. 6d. to 64s. xd. Pending the interim dividend announcement, British Plaster Board remained at 29s. at

the time of writing. Allied Ironfounders were little changed at 48s. 9d., as were Amalgamated Metal shares at 18s. 6d. British Aluminium at 47s. 3d. were at the level current a week ago. Elsewhere, Nairn & Greenwich eased to 68s. 1½d., and Barry & Staines to 42s. 6d. W. J. Bush moved up to 60s.

Boots Drug eased from 43s. to 42s. 6d. Timothy Whites were slightly higher at 33s. 6d., as were Sangers at 24s. 1½d. Greeff Chemicals Holdings 5s. ordinary were 7s. 9d., Monsanto Chemicals 5½d. per cent. preference 23s. 6d., Fisons ordinary 49s. 6d., and William Blythe 3s. ordinary were quoted at 8s. 9d. Elsewhere, Triplex Glass 10s. ordinary moved back to 36s., and International Paint at 115s. were lower on balance. On the other hand, Dunlop Rubber ordinary at 39s. 3d. showed a tendency to move against the general trend of markets. Leading oil shares were lower on balance.

Forthcoming Events

At the meeting of the **Society of Chemical Industry** (London section), in the Chemical Society's Rooms, Burlington House, W.1, on **November 1,** at 2.30 p.m., Dr. S. Judd Lewis will present a paper on "Spectrofluorescence: A General Survey, with special reference to the Sugars."

The Leeds area section of the **Institute of Chemistry** and the **Leeds University Chemical Society** are holding a joint meeting on **November 1,** at 6.30 p.m., in the chemistry lecture theatre of the university. Dr. A. D. Mitchell will speak on "Lecture Demonstration of Improved Methods in Volumetric Analysis."

At the Birmingham meeting of the **Electrodepositors' Technical Society,** to be held in the James Watt Memorial Institute, Great Charles Street, at 5 p.m., on **November 2,** Dr. D. D. Howat will present a paper on "Some Applications of Chromium Plating in Ordnance Manufacture."

A symposium on "Rubber-like Plastics and Their Applications" will be held at the joint meeting of the **Society of Chemical Industry (Plastics Group),** the **Institution of the Rubber Industry** and the **Institute of the Plastics Industry** that takes place in the lecture theatre of the Institution of Electrical Engineers, Savoy Place, London, W.C.2, on **November 2.** The meeting starts at 2.15 and ends at 6.30 p.m. Speakers will include Dr. W. J. S. Naunton, Dr. H. Barron, Mr. H. Rogers, and Mr. A. Ryan

At the first meeting of the new session of the **Royal Society of Arts,** at 1.45 p.m. on **November 3,** the president, Dr. E. F. Armstrong, F.R.S., will speak on "The Long Road of Progress."

A symposium on "Mechanisation in the Pottery Industry" is to be held by the **British Ceramic Society** at the North Staffordshire Technical College, on **November 3.** The meeting will last the whole day and starts at 10.15 a.m.

At the next meeting of the **Society of Chemical Industry,** Yorkshire section, to be held at the Queen's Hotel, Leeds, on **November 5,** at 3.30 p.m., Dr. William Cullen will deliver the first Brotherton Memorial lecture.

The **London Scientific Film Society** is holding a film show at the Imperial Institute Theatre, Exhibition Road, S.W.7, at 5 p.m., on **November 6.** On the programme is the Russian picture "Coal," which includes shots showing underground gasification.

Sir Henry Dale's second lecture to the **Royal Institution** on the treatment of infections will be given on **November 9,** at 5.15 p.m., and is entitled "The Beginnings and Growth of Chemotherapy."

At the joint meeting of the **Institution of Chemical Engineers** and the **Society of Chemical Industry** (Manchester Section), to be held at the College of Technology, Sackville Street, Manchester, on **November 9,** at 2.30 p.m., Major V. F. Gloag and Mr. R. J. Barritt will present a paper on "The Manufacture of Sulphuric Acid in Contact Plants."

CANADIAN PENICILLIN PRODUCTION

The Canadian Minister of Munitions and Supply, Mr. C. D. Howe, has approved a very large expenditure by the Dominion Government to finance the large-scale production of penicillin. The new industry will be located in Montreal and Toronto, and will employ about 250 men and women. It is understood that these plants will make use of a process developed by the Banting Institute at Toronto, which has improved the yield of penicillin from the mould. Unofficial estimates suggest that the cost of producing the new drug in the desired quantities may be \$1-2,000,000. Mr. Howe said that production of the British-discovered drug constituted the largest single order for medical supplies ever placed by the Department of Munitions. Initial contracts called for the production of 26,000,000,000 units of penicillin for the use of the armed forces.

The Government's appropriation will cover both the cost of creating this new industry and of the initial 26,000,000,000 units of penicillin to be produced. The Canadian industry is scheduled to come into operation by February, 1944, and to achieve an average weekly production of 500,000,000 units by mid-April. The Canadian enterprises are paralleled by plants in the United States, where there are twelve plants now in operation. Nine of these plants will shortly expand their facilities at a total cost of more than \$3,000,000.

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Second-hand
HEAT EXCHANGERS
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TWO—Vertical M.S. OIL HEATERS, with casing 15 ft. 0 in. high by 3 ft. 0 in. dia.; internal steam coil; fittings.

One—C.I. brass tubed CALORIFIER, 6 ft. 0 in. long between bolted-on end covers by 2 ft. 3 in. dia., containing nests of 1 in. brass tubing arranged in brass end plate; covers are fitted with 4 in. inlet and 3 in. outlet connections; two 4 in. flanged connections in the cast iron body together with 3 in. ditto.

One—Horizontal M.S. concentric tube type Kestner HEAT EXCHANGER; inner tubes 2½ in. bore, outer tubes 3½ in. outside dia.; six elements each 16 ft. 6 in. long.

One—Aluminium HEAT EXCHANGER or CONDENSER, containing 102 aluminium tubes 1⅞ in. bore; sundry flanged connections.

One—Horizontal aluminium concentric tube type HEAT EXCHANGER, built up from solid triple aluminium tubes with tubes 1½ in bore, 2½ in. bore and 3¼ in. bore; tubes have at one end removable branches; outer steam tubes have removable bends at side; unit comprises six elements, each approx. 10 ft. 0 in. long, complete with m.s. supporting frame and carriers and is interlaced with heating coils for warming exchanger if used on viscous material; overall dimensions 11 ft. 0 in. long by 5 ft. 8 in. high by 1 ft. 3 in. wide.

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None of the advertisements below relates to a woman between 18 and 41 unless such a woman (a) has living with her a child of hers under the age of 14, or (b) is registered under the Blind Persons Acts, or (c) has a Ministry of Labour permit to allow her to obtain employment by individual effort.

SMALL Firm engaged in experimental work requires small quantities of 40 per cent. aqueous suspensions film dried. Operators of machines suitable for this purpose are invited to communicate with WM. FREEDMAN, LTD., 60 Chesterton Road, London, W.10 Ladbroke 0417.

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GRINDING of every description of chemical and other materials for the trade with improved mills.—THOS. HILL-JONES, LTD., " Invicta " Mills, Bow Common Lane, London, E. Telegrams: " Hill-Jones, Bochurch, London." Telephone: 3285 East.

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PATENTS & TRADE MARKS

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THE Proprietors of the Patents Nos. 468,450 for Improvements in or relating to rosin size, and 475,259 Improvements in or relating to resin size are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring their full development and practical working in this country. All communications should be addressed in the first instance to Haseltine Lake & Co., 28 Southampton Buildings, Chancery Lane, London, W.C.2.

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1941, November 1st, 8th, 15th, 22nd and 29th.
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